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Forintek Canada Corp.
Cariboo Lumber Manufacturers' Association
and
Northern Interior Lumber Sector-COFI
presents

"Today's Generation in Sawmilling"

Objective Productivity Improvement

on

December 1, 1983
College of New Caledonia
Prince George, B.C.

Supported by

Department of Regional Industrial Expansion

Prince George

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Foreword

The following proceedings relate to a seminar entitled Microelectronics: Today's Generation in Sawmiling presented on December 1, 1983. The seminar was the second of four regional seminars, on the same theme, which were presented at various locations in western Canada. The preceeding seminar was held in Jasper and succeeding seminars were held in Kelowna and Vancouver. Financial support for the seminar was from the Federal Department of Regional Industrial Expansion.

Forintek Canada Corp. wishes to acknowledge the federal government contribution and the role of the Cariboo Lumber Manufacturers' Association and the Northern Interior Lumber Sector-Council of Forest Industries as co-hosts of the seminar.

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Opening Remarks

Craig Walden
Director, Forintek Canada Corp., Vancouver, B.C.

I'd like to take the opportunity of outlining how these seminars developed, how they came to be staged and who is involved.

It's a little better than a year ago that Forintek was approached by representatives of the Federal Department of Industry, Trade and Commerce and Regional Economic Expansion to determine our interest in staging seminars that would represent the educational phase of a much larger program, envisaged by the department as relating to the enhancement of productivity in industry, principally through the application of microelectronics.

One of the IT&C speakers at this seminar will underline the broader implications of the program, so I'm just going to explain how the particular seminars developed. The seminars are the educational phase proceeding the program and we were asked to undertake this with regard to the wood products industry. You should be aware, of course, that the program itself is national in scope embracing all Canadian industry and certain of the educational phases have already been staged for other industries such as mining. Before we accepted the commission, we felt it was absolutely vital that industry concur with us that it would serve a useful purpose and, assuming that concurrence was forthcoming, we should stage the seminars in the manner most acceptable to the majority of people in the industry. In this connection we contacted all the lumber manufacturing associations across Canada, on a one-to-one basis. We received a very strong endorsement of our proposal. At the same time it became apparent that if we were to reach the industry adequately, we must have a series of seminars, rather one as had been originally proposed, and that they must be presented on a regional basis.

We won the approval of our principals, namely IT&C, and this is the sixth in a series of regional seminars that are being presented across the country to the wood products industry. The four that have been given in eastern Canada to date have been in Ottawa, Timmins, Quebec City, and Moncton. The one given in Western Canada was part of the Alberta Forest Products Association annual meeting in Jasper on September 29, 1983.

A very important part of our proceedings has been the role played by the regional lumber manufacturers associations. There are two host organizations in addition to Forintek and we are very pleased and appreciative of the efforts and support of the Cariboo Lumber Manufacturers Association and the Northern Interior Lumber Sector, COFI.

We have an outstanding slate of speakers and I think we are very fortunate in our industry that at least we have some glimpse of what can be achieved through microelectronics. Even though we are regarded largely as 'hewers of wood', there's a suprising amount of sophistication in today's sawmilling and plywood industries. We have a glimpse of what can be achieved and of some of the gains in productivity that are available. Certainly there is already technology in place that literally can be utilized as fast as the capital can be acquired.

We are here to promote many things, but we have three major objectives for these seminars. We want to promote the linkage between technology and productivity. We want to facilitate information exchange. Also, a very important part of the proceedings is the input that we have from our labor representatives to make sure we appreciate the impact of technology change and to provide for an information exchange between the decision-makers on both the management and labor side of the operation.

* * *

Opening Address

George Richards
Vice-President and General Manager, Interior Operations
Weldwood of Canada Ltd., Cariboo Division
President, Cariboo Lumber Manufacturers' Association

In welcoming delegates, I wish to compliment both the organizers and sponsors of this program. There is probably no more topical or appropriate a subject than the application of computers to the sawmill industry for productivity improvement. For two reasons: first there is an acute wood shortage for the existing capacity and second, being an exporter of wood, the industry must be competitive. The necessity of being competitive is exemplified by the current recession.

Adversity has forced the industry to critically review its cost structure and the message is quite clear: unless costs are reduced, either through recovery or more product from a given volume or more product per unit of labor, or a quality product produced, the forest industry in British Columbia will lose its competitive position.

Furthermore, the North American industry must recognize that it can no longer take the position that this is the product produced and the customer must or will automatically buy. The car industry, hopefully, has learned this lesson and I hope the sawmilling industry does not have to repeat it. In other words, the industry must become more flexible. Remember, our forest industry largely relies on export markets and unless you are competitive in terms of price, quality and product, you will not survive. This is our challenge and there is no question that microelectronics will be an important tool in achieving this objective.

Where are we today in the use of computers in the sawmilling industry? Basically, the application of computer technology in the mill is in its infancy. But on the other hand, the availability of proven technology is fairly extensive and advanced. If one were to build a new sawmill or to modify an existing plant, proven technology exists for:

Process control

- Bucking
- Sorting
- Sawing
- Edging
- Trimming
- Drying
- Quality Control
- Machine control (programmable controllers)
- Management reporting

However, I would estimate that less than 10 per cent of the industry is taking advantage of this technology for the following reasons:

- Capital restraint
- Relative cost of systems
- Relative state of the technology

These are all legitimate reasons, but in the next five to 10 years the application of computer technology will be critical to the survival of our business. Therefore, it is imperative that the industry is prepared for this change. Consequently, our total work force is going to require training to handle this technology, and research and engineering must be directed to modify existing systems and identify new opportunities. As a general statement, state-of-the-art computer technology generally supercedes the systems technology of the industry. For example, the recent problems with the application of kiln controllers to the industry has clearly illustrated the fundamental lack of knowledge of the variables that affect the operation of a kiln.

Personally, I believe that both the educational and research facilities are well-positioned to accommodate this change, but both institutions require more direction from industry on priorities. If I were to identify a particular educational weakness, it would be the shortage of experienced sawmill programmers. Although in most of the research programs there is considerable dialogue with the administrative level, there must be more contact with the operating level.

One thing both the educational and research institutions and consultants must do to aid in the application of computer technology is to dispel the overwhelming image of computers. After being associated with the installation of several systems, it is amazing how quickly operating and mechanical personnel will be capable of handling the entire system it is simply not that difficult.

Another concern is that too many systems are considered without the full involvement of the operating personnel. No system will be completely successful without the input of this group.

A further consideration is to ensure any proposed system has a given objective and reasonable opportunity for a return on the required investment. The opportunity for capital investment is, and will continue to be, limited. For example, I would have no hesitancy in approving a trimming optimization system in an existing plant, but I would not approve a trimmer optimizer in a plant with a two saw trimmer because the return is marginal. Computers must be considered an operating tool and not a "me too" syndrome.

Looking at the future, computer technology in the sawmilling industry will become more sophisticated in existing areas and will be extended to:

- Preventive maintenance
- Designing
- Management
- Robotics

In summary, computer technology in the sawmilling industry is here and it will undoubtedly expand rapidly over the next few years as a necessary tool for the continued survival of this industry. It will demand the collective resources of all concerned to be effective. This program will undoubtedly provide some insight for those contemplating the installation of existing technology and will aid research and educational institutions in attaining this objective.

* * *

Forintek - its Role in the Program and the Forest Industry

Tony French
President and CEO, Forintek Canada Corp., Vancouver, B.C.

As Craig Walden mentioned in his opening comments, this is number six in a series of seminars. We have had a total of 600 people so far in these seminars across Canada so clearly there is a high level of interest.

George Richards has covered extremely well the issue of productivity as it pertains to this region. I would like to jump out of this region briefly and provide a perspective of the kind of input that bears on our R&D program at Forintek, and why we do some of the things we are doing.

I would like to pose a question. Why is productivity a major problem, particularly in Canada which has for so long been a dominant force in a scarce world resource? I would like to outline some statistics to illustrate that we are facing a very serious matter. The statistics that I refer to are drawn from a couple of documents. Probably the most interesting one is the Report of the Forest Industries Advisory Committee published in August 1983. The FIAC is an advisory committee to the Federal Government. It was chaired jointly by labor and management, Jim Buchanan of the CPU and Ian Barkley of B.C. Forest Products.

First, some supply and demand considerations. On the demand side, the FIAC report and another from the U.S. Office of Technology Assessment indicates that world demand for forest products will increase between two and three per cent per year over the next 20 years. About three per cent is involved in paper and about one in wood products. These are small numbers, but on a cumulative basis over decades clearly our industry is a growth industry; an interesting thought in view of the very real shortages of wood in this area that George has discussed.

World demand for softwood lumber is expected to grow by about nine per cent during this decade (less than one per cent per year) largely due to the decline of the residential housing in North America, Japan and Western Europe. The good news is that there is an increasing industrial usage in areas such as packaging, pallets and a rapidly growing home renovation market in North America. There are also some opportunities in non-residential construction, but here you have to be prepared to compete with steel and concrete; we have some technical work to be done in that area.

On the supply side, softwood sawlog supply is projected to increase less than one per cent per year on a world basis. That is, the physical supply is matched fairly well with total demands as, of course, it must be. The key point is that the delivered cost of timber will have a major impact on the allocated market share of world demand. Canada has enjoyed historical economic advantages in international competition; we have had an abundant supply of wood, with very good strength properties. Future world supply and demand, because it is going to be so much closer in balance, I'm convinced is going to be very price competitive. If we are going to be successful in maintaining our position in the world market, and many of you are involved in the export of lumber, then we will have to pay very serious attention to the question of price competition.

We are entering a very critical period in Canada generally, as we shift from a period of old growth timber to a managed second growth timber economy. Canadian production costs are projected to increase between two and three percent per year, while the costs in Europe are projected to rise only very slightly and the costs in the United States are projected to be almost flat. The higher Canadian costs will be largely due to higher harvesting costs, a steadily reduced wood quality and diminishing timber supplies. So we do have a problem. Cost competitiveness is the issue. And another emerging thought of course is product replacement. The composites are slowly moving into traditional uses of lumber.

Figure 1 shows some recent productivity trends in Canada. If you focus on the saw and planing mills, you will see that their productivity has risen above the all manufacturing average in Canada. Veneer and plywood mills have been well up there for quite some time.

On the other hand, although labor productivity has been increasing fairly steadily, real unit labor costs have also been increasing. In Figure 2 the thing that really stands out is the saw and planing mill situation, where labor costs have been increasing faster than productivity increments. I would like to emphasize, that this information is based on some indices which are designed to remove the effect of inflation. You are looking at real increases. The unit labor costs of veneer and plywood have been fairly steady, particularly in the last decade. It basically indicates they have been holding their own with inflation, over a difficult period.

It is interesting to look at productivity on a world basis. Where do we stand in Canada? Figure 3 shows that for labor productivity on a world-wide basis Canada leads the world. It leads the world in terms of physical labor productivity. In Figure 4, when we look at the indices again, we find that the Scandanavian countries, Sweden and Finland in particular, have been accelerating rapidly during the last decade. I think the key is their rate of change. Canada accelerated in its productivity, but in the last few years has been dropping again.

Labor isn't the only aspect of productivity; capital is another one, and George Richards in his discussion focussed on a number of issues in this area. Unfortunately, in Figure 5 I have gone totally metric, so my numbers don't quite relate to his. Capital productivity is a difficult item to measure. It indicates the current level of applied technology and as a proxy we have used recovery, or the cubic meters of solid wood volume in the rough divided by the cubic meters of product. The key to these numbers is that the smaller the number the better. If you look at sawmilling of softwood, you notice that the United States figures were based on actual dimensions while the others are based on nominal. When you convert, the United States figure is between 1.85 and 1.95. This puts Canada in the worst situation in the major lumber producing countries of the world; worst in softwoods, worst in hardwoods, worst in plywood, best in particleboard and best in fibreboard. In these latter two areas we have new capacity, and some of the best available technology in the world.

Figure 6 shows the demand projections for Canadian softwood timber harvest which are well known. It illustrates from some national statistics that in the not-too-distant future our demand projections for fibre will require us to move into timber reserves that may not be economically accessible; harvesting costs, quality and availability.

There are many examples in our industry of very efficent use of technology. George Richards indicated that roughly ten per cent of the industry is taking an active look at the application of what some people call 'space age technology'.

Research and development can be a very significant factor in developing the future technology available to industry. Canada, however, has historically spent less on R&D than its major competitors in the wood product industry around the world. Figure 7 shows some figures for the total expenditures in a number of countries; the United States spends four times as much on R&D than Canada. Well is this important? I think it is. It is through properly directed R&D that new technologies can be identified and developed to assist you in remaining cost competitive.

It is through R&D that technical support comes to the development of codes and standards. We spend one-third of our annual budget working on subjects in support of codes and standard matters for Canada, the United States and just about all of the export countries for Canadian wood products.

We have a capable and skilled labor force in Canada, and I believe we have got a growing emphasis on training and education to further develop those skills.

Technical skills that develop within the R&D environment contribute to training and education programs in our industry. This seminar is an example; earlier this week we held a two day kiln drying course here in Prince George; in the coming year we are scheduling a total of forty-eight regional seminars in British Columbia and Alberta on various topics from saw filing to lumber size control. The lumber size control is being done in co-operation with COFI and of course COFI mills in this area.

Figure 8 shows the three basic areas of the Forintek program where Forintek can help, and can show an excellent return on investment in your business. The Forintek budget is $11million dollars a year. We have two hundred people distributed between a lab in Vancouver and another one in Ottawa. The program is directed by a research program committee of industry, specialist and government people. The way in which this is carried out was described in the November 1983 issue of Forintek Review, our monthly magazine. The research program committee is a process through which we receive input from you to guide our technical program.

George Richards made an important point; we don't see enough input to our technical program from

operating people who are out on the line every day. At Forintek we are now pushing our lumber people particularly, out into the mills for visits, joint projects and discussions about problems. This is important for research people; they are not operators, but research people who have trained technical eyes and minds, and will work with you to identify problems that they can address, and make a contribution to solving your problems.

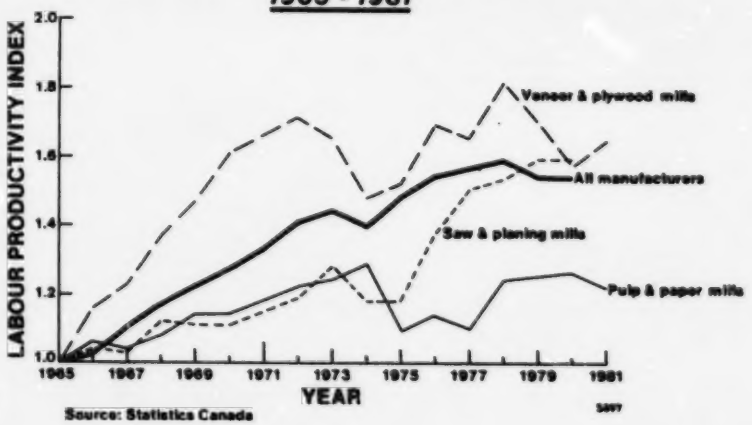
To sum up, Canada may have some difficulties with its changing raw material base, its wage base, and its capital productivity as it strives to remain very cost competitive, as it must, on the world market. On the other hand we have some very real opportunities in a good level of physical labor productivity, a growing awareness of the value of training and education, and a number of new and emerging technologies that you are going to touch on today. Our industry is vital to the economic health of Canada. We must ensure that it will remain competitive in the years ahead of us. It is for these reasons that Forintek is presenting this series of productivity improvement seminars across Canada. These thoughts are guiding the review that we are undertaking at the present time of our R&D program for the next five to 10 years; we would really welcome more input.

You may have felt in the past that R&D is a thing that is somewhat academic, ivory towerish. We are trying to move our program, ourselves, our attitudes out of that mode of operation and become far more intimately involved with your needs, your opportunities and your future, because your future is our future.

* * *

Figure 1.

LABOUR PRODUCTIVITY IN THE CANADIAN FOREST INDUSTRIES 1965 - 1981



Source: Statistics Canada

Figure 2.

INDICES OF PRODUCTIVITY AND UNIT LABOUR COSTS - CANADA (costs in 1965 funds)

Figure 3.

LABOUR PRODUCTIVITY IN SOLID WOOD PRODUCTS (m³ per man hour)*

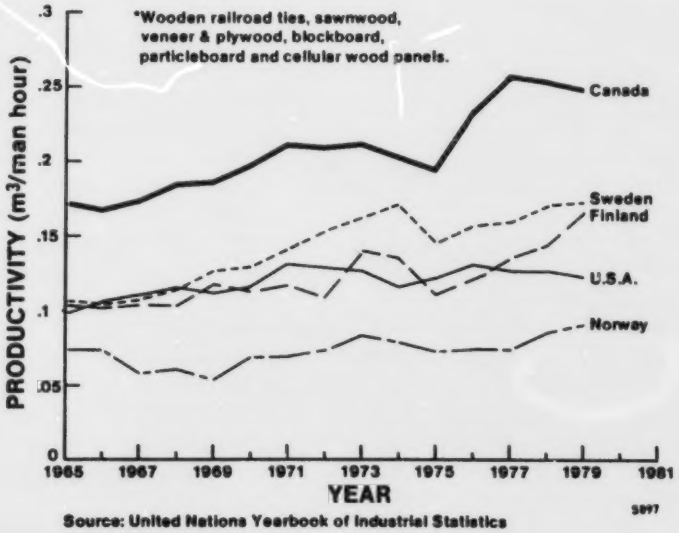
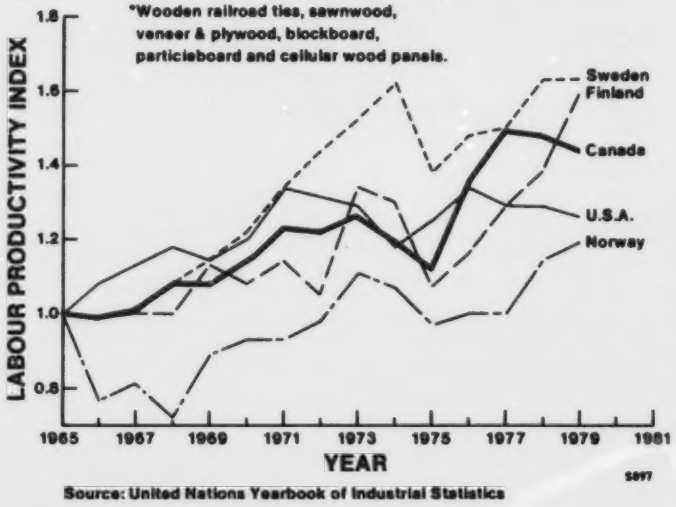


Figure 4.
*LABOUR PRODUCTIVITY INDICES IN SOLID WOOD PRODUCTS**



Source: United Nations Yearbook of Industrial Statistics

Figure 5

Conversion Factors Relating Input of Raw Material to Output
(m^3 solid wood volume in the rough/m^3 production)

Country	END PRODUCT				
	Sawn Softwoods	Sawn Hardwoods	Particle-board	Plywood	Fibreboard
Finland	1.93	1.68	1.24	2.94	1.41
Norway	1.97	–	1.48	–	1.61
Sweden	2.00	1.84	1.48	2.54	1.74
Canada	2.05	2.26	0.96	2.71	0.79
U.S.	2.61*	2.09	1.45	2.22	0.80

* Production based on actual dimensions, all others are based on nominal dimensions.
Source: F.A.O. Conversion Factors for Forest Products.

Figure 6.

CANADA'S SOFTWOOD TIMBER HARVEST: DEMAND PROJECTIONS

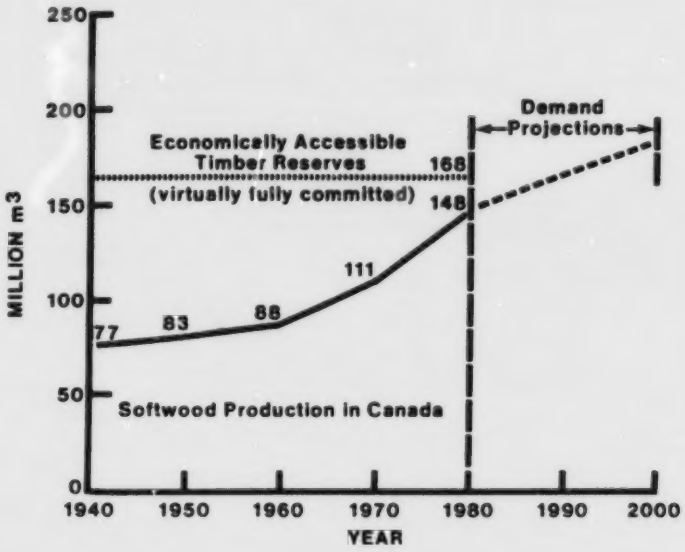
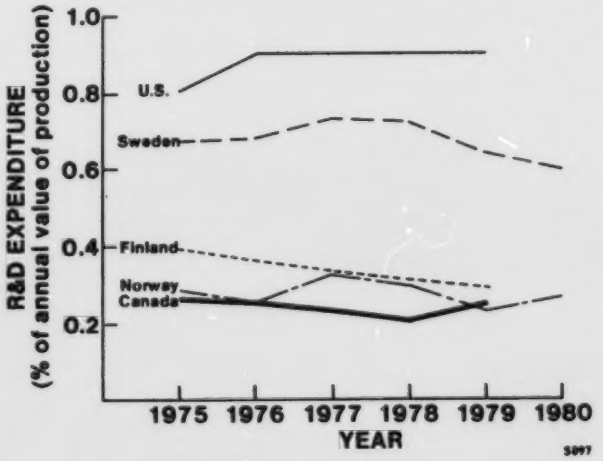


Figure 7.

RESEARCH AND DEVELOPMENT EXPENDITURES BY GOVERNMENT AND INDUSTRY IN WOOD BASED INDUSTRIES



Sources: U.S. National Sciences Foundation
U.N. Yearbook of Industrial Statistics
Dept. of Industry, Trade & Commerce, Canada

Figure 8

- Identify and develop technology
- Develop and support codes and standards
- Develop training and education programs

Where Are We Going? Microelectronics

Bob Blanchard
1st Vice President
Western Canadian Regional Council No. 1, IWA
Vancouver, B.C.

I am presenting this outline as a result of a request from Ray Clarke, the associate director of Forintek, to the International Woodworkers of America to have labor's views expressed at this gathering.

For the past five and one-half months, we have been playing our traditional role the adversaries. We have been performing this role at the bargaining table. However, these kind of gatherings are beginning to indicate that though we have an adversarial role to play, we can also work together to resolve common concerns.

I want to preface my remarks by stating that most of my experience in the forst industry has been in coastal operations. There has been very little opportunity to see the effects of technological change down there. I understand you are a little more into it in the interior versus the coast.

Let me state quite clearly that the opinions I express here today are not necessarily views and opinions shared by the entire labor movement. In actual fact, I would venture to say that the IWA's philosophy towards the introduction of technological change differs considerably with other labor bodies, be they public or private sector unions.

The IWA has traditionally supported the need for modernization. The truth is, we have publicly admonished the forest industry in B.C. for their lacklustre performance in updating their operations; in actual fact, you could say we have made a career of it.

The unforunate tardiness (and I use the word loosely) has cleared a legitimate and growing concern for us, however. A slow and steady or partial introduction of technological change would have allowed the transition to take place with little or no direct job loss as a result of a computerized conversion. The decrease, if any, in jobs and membership would have been absorbed through natural attrition.

The ramifications of a complete and total changeover of an entire mill or mills causes untold consternation for the union, the employer, the government, the economy, but first and foremost for the employees facing displacement, retraining or, even worse, unemployment.

Historically, employment growth in our industry has been slow relative to other sectors of the economy. For example, over the past four decades the significance of manufacturing employment has diminished substantially; in 1940 it accounted for approximately 40 per cent of all non-agricultural employment but by 1980 that figure had declined to only 22 per cent. The era of microelectronics will accelerate that trend.

Technogical change is not creating jobs in our industry; it is creating employment in the high-tech field. The only specific exception to that statement is in the trade categories. The ratio of trades people vs. production workers has teetered dramatically in favor of the maintenance personnel. The traditional skills of the trades has had to be drastically revised to accommodate the introduction of computers.

The IWA, as I stated earlier, supported the introduction of modern production methods, not for any sanctimonious reasons; we were chiefly interested in the elimination of the onerous, tedious and back-breaking jobs found in our industry. Unfortunately, the child, in our eyes, has become a monster. Technology is beginning to hurt the worker *per se*.

The high-tech syndrome now reaches out and attacks the skilled and semi-skilled as well as the

laborer. The high wage earners, i.e. sawyers, are becoming 'attendants' rather than 'operators'.

We are on the horns of a dilemma. We recognize and support the need for change in order to survive in the competitive world market, but what good is survival if the right to retain an income is taken away from you as a result of modernization.

The primary industry which we the IWA represents had a membership high of approximately 58,000 in 1978-1979. We will be fortunate to maintain a level of 40,000 membership the coming years.

Now, I don't expect everyone to shed too many tears over the plight of the poor IWA. But I do expect some insight into what will happen to the increased products being produced when the potential consumer base is shrinking even faster than productivity is spiralling.

Employers and governments yes, even you and I have an obligation to maintain the delicate balance needed between producer and customer. Ideas that seemed unheard of 20 years ago, ideas that seem radical or unrealistic today, must be explored, must be considered, must even be introduced or enacted.

The present day employer must undertake an extensive program of retraining. He must also give more than 'passing thought' to guaranteed annual salaries, productivity sharing, or a 'workable' form of job sharing.

Governments must be cognizant to the possibilities of early retirement, bridging of pensions and drastic reductions to the work week as it presently exists. More specifically to the forest industry, governments must release the millions of dollars needed for reforestation and silviculture. Failure to do so could hasten the demise of our industry at an even greater speed than it is today.

You and I must set aside some of our traditional hang-ups and bug-a-boos and re-tool our thinking; we must learn to co-exist with the advent of the microelectronics generation. Those things that seemed absurd and preposterous a decade ago may be our only chance of survival tomorrow.

The forest industry's profile, especially on the coast, is going downhill. We must turn that around. They are losing their effectiveness on the economy and that is self-defeating.

The large, integrated companies must change their attitudes; they must become more aggressive in the area of export. Being solely dependent on one market is wrong in this age of computers. Industry must capture the alternative markets in Japan, China and the U.K. We have to improve our markets to be able to use our new-found technology so that we can utilize those high cost, high quality trees. That, under today's production methods, makes them economically useless.

I could have gone into a long statistical dissertation on the effects technological change has had or is having within our industry. I could have given examples of the new versus the old. But what for? It will suffice for me to say that the leadership of the IWA understands the necessity for change, but we equally understand the need for a parallel program and change in attitudes designed for resolving the plight of the displaced or unemployed workers.

In closing, I would like to mention that I had the opportunity to tour Europe with a joint group of labor/management people to study industrial democracy's role there. Our union preached about more industrial democracy in the workplace, while a lot of management people were coming back from Europe saying, "Boy, they have got Utopia over in Germany and Sweden, you people should see what it's like over there." So we went to Europe, six of us from each side, and we all came back with the same final thought. Some of the things they do over there as far as industrial democracy goes may work well in Europe, some of it may work in Canada, but our systems are so different that to try and attempt to bring any program from one country to another and make it work is totally impossible.

If we are going to develop a program in the field of industrial democracy or technological change, then we have to do it within out own country and not with the exclusion of specific groups. Every group has to be involved and that includes labor. We play an important role. The attitudes of all of us must change drastically or the era of the 'chip' may herald in the final curtain.

* * *

Training Programs to Meet Industry Needs

Charles McCaffrey
Principal, College of New Caledonia,
Prince George, B.C.

First of all the title is Training Programs to Meet Industry Needs. And I am delighted with the second half of that title, the "to meet industry needs" phrase. Having been 32 years in the education business, if there is one thing that has distressed me over the years, it is the thousand training programs we have run in this country at government expense, and sometimes at the expense of companies, that don't meet anybody's needs, industry's or the employee's or anybody else. All they really do is keep people off of the streets for a while, who are fundamentally unemployed. I guess it solves the problem of getting them off the streets. In turn, I have to hire teachers and it saves the teachers being umemployed.

I'm a Scot and I hate to see my money being wasted that way, so "industry needs" is what training is all about, and I am delighted with it.

The special needs that we in this institution see in terms of training for the industry in the late 80's are as follows. You are, all of you, involving yourselves with new technology at different levels. We know there are companies also exploring and actually implementing product diversification. New technologies and new products means new skills. I hope, in many cases, new skills for the existing work force, rather than simply displacing the existing work force and bringing in bright young people to replace them. And I have nothing against bright young people; I just think that people that happen to pay taxes for twenty or thirty years deserve a break too that's the existing work force. There is a special need.

You are all looking at technology because it is part of survival, improved productivity. Improved productivity also means new kinds of skills to look at the old problems in a different way; it means training of a different type.

I am told that, increasingly, the supervisors in the sawmilling industry, as was pointed out by Bob Blanchard of the IWA, the supervisors have to know the whole operation as a total entity and not just part of it. And they have to know it at on an operating level, not just a theoretical level. And that operation, if it becomes more technological, becomes more complex. That means just having the worker doing it; knowing about it is not good enough. The supervisor above him has to know about it too because he has to make key decisions.

And then finally I am told that the industry has an aging work force. I get sensitive when people talk about aging work forces, because I am now part of it. But I am told that in some of our major companies in B.C. right now as many as 70 per cent of the major decision-makers will have left the industry within the next five years. That needn't be a problem as long as the people are being trained to take over from them. And that is a very specific aspect of industrial training that I think we need to give more attention to.

If we look at training, I would just like to share a few facts and figures that many probably know better than I. Nearby is Lakeland Mills and by improved productivity, by buying improved new equipment and by introduction of new processes they have increased their recovery. They have reduced from three shifts to two, and still improved output. The manpower, however, has remained the same, from 56 to 60 workers. However, what is interesting is the shift from unskilled to skilled. The unskilled work force has dropped from 18 to 10. However, the number of electricians is up by four, the number of filing operators up by four, the number of millwrights up by three. In other words, within that existing mill a clear shift from unskilled to skilled has been part of the process of improved productivity. Surely, that is where we are going.

The second thing I would say about that, however, is that that training was done mostly on the job. And I would submit to you as a person who is on the institutional side of the business, that for far too long we have assumed that institutions can do too much of the training. Much more of it has to be done on the job in partnership with the industry, and directed specifically at a better return on the investment on one hand, and better working conditions for the employee in the plant on the other. That is what it is about, and you can't do that sitting in a college classroom. It doesn't mean to say we have no role. We have a role, but we can't pretend to solve everybody's problems all of the time, or at least every time we try to do it all we fall flat.

Recently the Federal Government under the Critical Skills Training Program, together with the Skills Growth Fund established a year ago, has targeted the national resource sector as an area of priority. They have identified anticipated national shortages in forestry technicians, forest product technologists, electrians and electronic technologists four fields that I think all of you have a direct need for. They are now national priorities in the eyes of the federal government at least. At the provincial level, millwright, planermen, lumber grader, wood pattern, microcomputer and supervisory skills have been identified as areas where we will have difficulties in the next five to 10 years unless we do something about training. Now the federal program, having identified the priorities as national projects, has now put into place a procedure whereby if a person already has the technological training, an employer can pick-up $6.25 an hour for a two year period for ongoing training of a member of the work force. That represents a fairly sizable investment from the federal side in the upgrading of your existing work force. It is a fairly recent announcement, and it is one that you may want to think about very seriously. And clearly if an institution like this can be of assistance, we are interested, but that is not the most important thing.

In identifying those priorities in terms of training, let me share with you a little personal concern, and then I'll say something about what we are doing here. The personal concern I have is this. It is entirely understandable that in a day and age where we have a million unemployed, in a day and and age where more people are assuming we will always have a million unemployed, there is an understandable reaction that says, "well, with all those unemployed we shouldn't put money in training". It is understandable, but it is suicidal. It is absolutely suicidal. We have to advance the thesis in this college, that the time of significant downturn in economy is the time when you should be investing more time, more money, and more energy in raising the skills of your work force. Because the one thing that is certain is that five years from now when things are turning around, we are going to need in all of our industries higher and higher levels of skills. If you don't train these skills in today's Canadians, then you will buy them from foreigners tomorrow. And when you go that route, it is not a million unemployed you are looking at, it is very many more. So the investment in training is an investment in your future.

At CNC we, at present, have two year businesss programs, two year electronic programs and forestry and electrical apprenticeships. They all relate to your activities. We have a transfer program in lumber and plywood ready to go.

More important, though, the immediate training needs of industry, in my judgement, do not revolve around two and three and four year programs. That is totally unrealistic. The universities chose that route years ago and we have allowed the university pattern to dominate the college pattern. What we need more of and what this institution and others are moving to are programs like the Forintek seminars. Two week courses, one week courses, weekend workshops, six week sessions, courses where the individual can be working half time for a limited period of time so that he combines the earning capacity on one hand with the learning capacity on the other. This makes more sense from everybody's point of view. We this summer, in partnership with BCIT, ran a pulp summer institute for one full week; 60 people attended. It was sold out; it was actually more than we had originally planned for. We are running at the present time, again in partnership again with BCIT, a six week industrial electronics program. We will be starting in January a soils and ecology program with RPF Credit, provided by UBC, but through CNC. Forintek ran a lumber drying course the last two days here and the attendance yesterday was in excess of 30 people. Vibration analysis, a one week program, is in preparation in CNC for next summer. We are running management skills programs for supervisors that consist of four three-day sessions spread out over a two year period. It is 12 days, but it is over two years, so it can be fitted into work schedules. And you would then be slotted in with other suitable industrial people.

We have looked recently at a two week planer mill program that was being run successfully by West Fraser. I heard great things about it. I gather it has folded. We are suggesting that maybe we sit down with West Fraser and see if there is any way that that successful program can be reactivated, the college simply providing assistance. Last summer we had a one day seminar with a speaker from West Germany on the Linck sawmill process. I don't think it has a very great application to the B.C. industry, but I am not an expert. The important thing is a lot of people got to see and understand and make their own decisions.

We are talking then about a training for industry that says, "it must be flexible in time." That means there is nothing wrong with a one day or a one week or a one month course. It doesn't have to have the dignity of a whole year. Flexible in terms of the arrangements, it can be combined with work and in some cases it should happen in the work place. Why are we not doing some of that training in the sawmills. There is no good reason why it all has to happen at CNC, or in any other college.

Secondly, there should be evidence of partnership. Among the things I just listed for you there were three or four cases it was CNC and BCIT, in some cases it is CNC and UBC, and in other cases it is CNC simply providing whatever assistance it could to Forintek. We are not really in the business, I hope, of any more empire building in education. CNC is not important, the service we provide is. If we can provide a service by somebody with more expertise doing so, then we are meeting our mission. Joint industry/college partnership is one of the keys.

Next, job specific training. If the job training is not specific to a job, then serious questions should be asked about investing corporate or public dollars in it. Now that is a bit of heresy. There are those who say we should spend a lot more time in teaching people fine art and philosophy and theatre and dance. We do all of those things in this college and they are important. But when you boil it down to the question of either giving the people the skills to move the economy and support their families or those other skills, there is any question where a simple Scot like I stands. It is called 'the basics of the economic survival come first'. Even if that isn't very popular, and doesn't get headlines, job specific training is essential.

And then, finally, we do need an critical look at the whole business of managerial training. Mangers who understand technology, who understand different kinds of engineering as well as management techniques. I was interested to hear the observation by the previous speaker about not transferring the industrial democracy concepts of West Germany here, and I couldn't agree more. They won't transfer. I would go further in saying the great fad we have at the moment about transferring Japanese managerial skills to Canada has just as much chance of success. It might be a device whereby consulting companies are running conferences at $600 a crack and making a big profit, but it has no bearing on the reality of Canadian industry. It just isn't going to work. We must design our own managerial skills for our own world of today. Not Japan's world of yesterday, nor Germany's world of tomorrow.

Finally, CNC is in process of establishing another institute which will be separate from the College and which, within the next two months, will be dedicated to advanced technology for the forest and mining industries. We already have about $3 million dollars worth of CAD/CAM equipment in boxes. We will have in excess of $100,000 for robotics. And we will be adding specialized training in automation, hard automation systems for sawmills, robotics, numerical control, laser technology and fibre optics. The thing about that institute, when it opens, is that it will have an industrial board, it will not run under the Ministry of Education. Its target is that within five years it will run by supporting itself, by doing training for industry, by doing applications engineering and by providing that kind of assistance directly with industry. I know that we can design institutions which can, in partnership with industry and acting as industrial enterprises, support itself without day-to-day dependence on government grants. Perhaps a measure of that approach in our colleges today would cause us to reconsider our present programs. The Institute will work for industry, with industry and like industry.

* * *

The Industrial Regional Development Program

Bob Inkpen
Manager, District Office, Department of Regional Industrial Expansion
Prince George, B.C.

I represent a department with very long names, the Department of Industry and Commerce and Regional Economic Expansion which was formed two years ago when these two departments were merged together. You need not remember that name, because on December 6th of this year (1983) we expect to get a new one the Department of Regional Industrial Expansion. The Department is the sole government focus on industrial development in Canada.

The mandate of our department is to increase the economic prosperity of Canadians in all regions of the country, by doing a number of things: by stimulating the establishment, expansion, productivity, competitiveness and innovative capability of business enterprises; by enhancing regional industrial benefits from major projects, such as northeast coal and the Alcan smelter; by supporting industrial restructuring, restructuring of renewal for firms in communities that are facing declining markets; by assisting firms to access international market opportunities; and by fostering environments supportive of innovation of business.

My department recognizes that there are a number of major problems facing the forestry sector, which have to be overcome if industry is to maintain its international competitiveness and its market share in the face of their diminishing resources.

On the international front, my department and the Department of External Affairs are working to lessen tariffs and to remove non-tariff barriers, such as overseas building codes, which reduce the access of our products to foreign markets. Our department can also provide assistance to an exporter of forest products, to seek out foreign markets, or to provide assistance to bring foreign buyers to Canada to put in touch with Canadian manufacturers.

We have a new program which was approved by parliament on June 30th, 1983. This program is known as the Industrial and Regional Development Program (IRDP) which takes seven programs which are offered by my two departments and combines them into one program, which has resulted in a more streamlined approach to economic development and a simplified application procedure for manufacturers.

What I will do now is just present a very brief overview as to what that program is all about.

First of all, the IRDP has been divided into four tiers. The country has been analyzed in terms of regional disparity, personnel income and unemployment, and four areas of the country have been identified. This identification was done on the basis of census divisions which British Columbia is coincidental with the Regional District structure. By dividing Canada into four levels, it has been recognized that the poorest parts of the country may require the most generous support. Other areas of the country are relatively better off, and therefore would require less backswim assistance.

The Prince George district office serves northern British Columbia from 100 Mile House north to the Yukon border and from Pouce Coupe to the Queen Charlotte Islands. Of the six regional districts in the north Cariboo-Chilcotin and Kitimat-Stikine are identified as being more disadvantaged. The other four regional districts are among the most prosperous 50 per cent of all census divisions in the country and obtain the least generous support under IRDP in terms of maximum levels of funding assistance.

Having said that, when we do provide public support, we try to look at a number of factors which will determine the amount of support that we will provide. The first thing that we look at is project liability. The project must be able to support itself with the maximum government assistance. If, with the maximum contribution we provide, the project still does not make economic sense, it would be folly

to provide funding. Secondly, the project must demonstate a need for public funds. If an applicant has resources sufficient to undertake a project without government funds, then we would expect that they do that without our support. Government funds must really make the difference for a firm to do a project now as opposed to some time in the future. Finally, the project must result in some significant benefits to Canada. Hopefully the project would increase employment and exports or reduce imports, and be non-damaging to other Canadian business. We also look at projects which use new processes or create new products. Again, the amount of funds that we provide is hopefully what is required to get a project to proceed. In the better-off areas our maximums are lower, but it may very well be that the amount of funds we provide to one firm in a well off area and the amount we provide to a familiar firm in a poor area would be the same.

Well then, what kinds of assistance are available to the forestry industry under our program? There are a number of elements. Firstly, we can provide funds to improve the industrial development climate of an area. Under industrial climate funds can be made available to economic business or technological institutions for studies in specialized common services. It is under this program that we have funded this seminar and by which we provide support to organizations such as Forintek. It is also under this program that we provided money to develop a pulp and paper research institute at the University of British Columbia. Incidentally, studies paid by the federal government in this area are available to all people within the industry.

A second element includes the establishment of new manufacturing and processing firms. I think it is fair to say that in this part of British Columbia, with a dwindling forestry allowable cut and the very difficult competitive market, it will be unlikely that we will be funding new sawmills that aggravate log supply problems and increase substantially competition in the industry. Those sawmills we do fund will likely be involved in products which are currently not widely produced such as hardwoods, or those sawmills that further refine the product they have. We have been involved in the Prince George area in firms which produce furniture components for Ikea, and with firms that are producing various kinds of siding and panelling.

A third element of IRDP is funding for expansion of manufacturing and processing businesses. In forestry, most emphasis is being placed on firms producing a new product that has a fairly good market demand and have an adequate supply of timber.

A fourth element of IRDP is modernization which, for such projects in the forestry sector, will receive our major attention. Assistance can be provided in a number of ways. Funds may be provided for studies to determine the feasibility of modernization projects. Assistance can also be provided for the acquisition of new and advanced machinery and equipment which specifically enhances the productivity of the firms existing activities in manufacturing and processing.

A fifth element of IRDP is the adaptation of microelectronics technology to manufacturing and processing. Funding is available to manufacturers and processors for the first installation of microelectronic devices in their plants, for the design of custom microelectronic devices, and for the incorporation of electronic dependent products or systems in the products processes, production methods, and so on.

For projects involving plant establishment, plant expansion, and plant modernization, up to 25 per cent of approved capital costs can be provided in Bulkley-Nechako, Fraser-Fort George, Peace-Liard and Skeena-Queen Charlottes with grants of up to 35 per cent in Cariboo-Chilcotin and Kitimat-Stikine Regional Districts. For microelectronics technology, grants of 50 to 60 percent of approved capital costs can be provided.

A final component of IRDP relates to innovation. A fair amount of research relating to the forestry industry is being undertaken by universities, forest research companies, and equipment manufacturers. As new technology may not yet be fully proven, its introduction to industry may be very risky to a lumber manufacturing firm.

For those products and processes which are unique and which promise potential benefits in the industry, the federal government can, under IRDP, provide non-repayable funds of up to 60 per cent of that technology. My department can also assist in other forms of innovation. Some products, new processes and so on may have been introduced into a couple of sawmills but may not have been widely proven, with some of this technology requiring development to meet very specific needs. In these cases where the risk is lower, we can still provide assistance up to 60 per cent of the cost, but this assistance is repayable, provided that the technology is successful. If the technology is unsuccessful, then a certain amount of the funds that we provide may be forgiven.

This basically covers the Industrial and Regional Development Program. In summary, our department's priorities in the forestry sector in British Columbia focus on the introduction of innovative products and processes; the modernization of existing

plants so that efficiency is increased and waste reduced; and the development of new markets.

By helping the forestry industry increase its competitive position, firms will then be more successful, the jobs they provide more secure, and ultimately the communities in which they are located more prosperous.

* * *

Profit Opportunities Through High Technology

Jim Swanson
Manager, Lumber Manufacturing Technology,
Forintek Canada Corp., Vancouver, B.C.

I would like to review some of the experiences we have had at Forintek, based on our files and studies, that will indicate existing profit opportunities in sawmilling operations. The worldwide focus today is on improving productivity and recovery in sawmilling operations.

Forintek has been involved in these activities for a number of years through a project known as the Sawmill Improvement Program. It began in the Eastern laboratory when Forintek was part of the Canadian Forest Service, Eastern Forest Products Laboratory. With the formation of Forintek, these activities have expanded rapidly. In the past four years, we have had the opportunity to study in excess of 70 individual sawmill log breakdown systems in over 50 different sawmills. As a result of these studies, we have gathered a large amount of information and data. We generally find several areas in the manufacturing process that lend themselves readily to improvement. We have made the objective of the program to identify these areas in existing operations and estimate their potential economic impact.

There are at least six areas that can nearly always yield substantial benefits (Figure 1). These include the following: improving the log quality entering the mill, paying careful attention to the log allocation within the mills, optimizing log breakdown procedures, minimizing lumber sizes, improving productivity itself and establishing efficient drying practices.

All of these can have a substantial impact on the overall profitability of any sawmilling operation. For a few minutes, I would like to discuss examples we have generated with actual mill data. I'll start with improving log quality entering the mill.

In the area of log quality entering the mill, there are five or six areas that we are particularly concerned with. The log quality entering the mill is extremely important for several reasons, one of the primary ones is that mistakes, particularly in log bucking, cannot be corrected anywhere else in the manufacturing process.

Normally, we are concerned with sweep, crook, log length, over length and debarking, to name a few (Figure 2). There have been extensive studies, and much information published on the effects of sweep and crook. I don't plan to cover these areas extensively. The other three points including log length, over length and debarking, are areas that should not be overlooked because there is often room for substantial improvements in economic benefits in these particular areas. Let me explain what I mean by log lengths.

Generally speaking, we like to produce log segments that will produce lumber in the sizes we are going market. In other words, we want to produce a correct nominal log length and give it a minimum trim allowance only. We collected data in a number of sawmills. Here are examples of some things we often see. This mill was marketing even length lumber in eight, 10, 12, 14 and 16 foot lengths which is fairly common. Generally, we market in two foot increments. The Number One log was 12 foot 9-1/2 inch actual log length. This log should have been trimmed to 12 foot 5 inches. It actually had a four and a half inch overtrim. Another log in the same batch was measured at 11 feet 10 inches. This situation is extremely detrimental because to get back to the next nearest lumber size, almost 17 inches of trim has to be removed. This represents a substantial loss in fibre. In a 16 foot log, that represents a 12-1/2 per cent loss of lumber. Although it is an extreme example, it is not uncommon.

In another sawmill producing even lengths, we found the average trim was running 6.9 inches in excess allowing for even and odd lengths. The particular mill, however, was only marketing lumber in the even lengths, so the actual overtrim was 8.6

inches. If we assume a five inch trim would be sufficient for this entire group of logs, the overtrim would average 3.6 inches.

If this could have been recovered as lumber, what would the benefit be? (See Figure 3.) We found that assuming most of the overtrim could be turned into lumber by careful bucking, we could increase our lumber recovery from 6.4 to about 6.51, for a lumber recovery improvement of 1.7 per cent. Now, 1.7 per cent is not a great deal, but what would it mean to a lumber operation producing 100 million board feet of lumber per year? It would add an additional 1.7 million board feet of lumber to that operation. We have calculated the potential benefit by assuming a selling price of $200 a thousand and subtracting a drying allowance of $12 per thousand and a planing and dressing allowance of $26 to come up with an additional lumber value of $275,400 (Figure 4). We would lose chip revenue, so we adjusted for lost chip revenue and still show a benefit amounting to almost $210,000 from a 3.6 average overtrim.

I will now discuss the area of debarking. Substantial savings can be made in debarking. We have a tendency to use too much pressure or too little pressure in debarking and as a result we end up with chips in our bark or bark in our woodchips. Bark in the woodchips is bad. These errors result in lost premiums from the woodchip buyers, or lost lumber recovery.

We used the Best Opening Face Program to simulate the effects of using excess pressure in the debarker and removing, inadvertently, a tenth of an inch from the log (Figure 5). A tenth of an inch all the way around would result in two tenths of an inch reduction in diameter. This calculation is based on a 6.4 inch diameter log, 12 feet long. We assumed it to have two inches of taper, and used the split taper and log cant portions of the Best Opening Face Program. You can see that normally this log would be expected to yield 27 board feet of lumber. If we removed one tenth of an inch of fibre because of debarking errors, this would be reduced to 24 board feet of lumber resulting in a reduction of lumber recovery factor from 7.22 to 6.42, or 11.1 per cent. What could this mean to a lumber operation producing 100 million board feet of lumber? (See Figure 6.) If we assume that instead of 11 per cent we only get two per cent, and ignore any revenue out of chips, we would add an additional two million board feet of lumber per year. Adjusting the value for drying and planing, we come out with a net benefit of $324,000 from a 1/10 inch loss of the outer shell of that tree.

Now let's discuss log allocations. Generally we are talking about yield and recovery as a function of production lines, and/or productivity as a function of production lines, and also profitability by diameters. The first two areas generally refer to running two production lines simultaneously. We studied a two production line mill. The small log line was designed to handle logs under seven inches, and the large line logs over seven inches. We found 10 per cent of the large logs were actually less than seven inches, so they were below the minimum, and 20 per cent of the small logs exceeded the seven inch diameter maximum. We analyzed that data for optimum allocation. The results are shown in Figure 7. We see that had the logs been processed on the proper line through optimum log allocation, we could have increased our lumber recovery from 5.77 to 6.01. This represents an overall improvement of four per cent in lumber recovery. What would this mean to a sawmill producing 100 million board feet. The four per cent increase would add an additional four million board feet annually to this sawmill (Figure 8). This additional lumber would have a value, adjusted for planing and drying, of $648,000. However, we would lose chip revenue. When adjusted for the loss in chip revenue, we obtained a potential net benefit to this operation of $492,000 based on proper log allocation.

The third area involves optimization of log breakdown and log breakdown systems. We all know the cost of delivering wood into the sawmill is rising rapidly so there is a strong emphasis and need to improve lumber recovery. We must remember a couple of points regarding applications of new technology. The log breakdown process itself is one of many processes in the mill. The overall recovery is only going to be as good as those processes that both precede and follow the log breakdown system itself. We can have the best computer controlled breakdown system, but if we are doing a lousy job either before or after, we are not going to get the full benefits.

There are some substantial things one can say for computerized log breakdown. Firstly, computerized log breakdown minimizes operator errors. Secondly, it allows you to target breakdown patterns for marketing purposes, either to maximize value or to produce products that are more marketable. This can have significant impact in terms of marketing. Computerized optimizing systems are dependent on two things: efficiency of the scanning system and efficiency of the diameter sort to sawing diagrams at the headrigs. The 11 per cent difference in recovery that we considered at the debarking station due to taking away a little excess fibre around the log can also occur at the headrig if your scanning is not accurate.

Now let's look at minimizing lumber size. There are three things that we generally have to do to maintain minimum lumber sizes. Firstly, we have to establish a minimum lumber size for our particular sawmill. Secondly, we have to track it on an ongoing and careful basis and stick to it to reap the benefits. What

are the components of a lumber target size? They include the final dry, dressed lumber marketing size, the green dressed marketing size, a planing allowance if we are planing, a shrinkage allowance if we are drying, and a sawing variation. Any lumber or wood in excess of these can be considered oversizing and unnecessary. We generally lose the excess in the form of lower value planer shavings. We would like to recover it as higher value chips and lumber. The following is an example of reducing a target size by 1/16th of an inch. The simulation indicated that the top two by four was increased from 12 to 14 feet by reducing the target size a sixteenth of an inch. This translates into a lumber recovery of about 2.6 per cent. Many mills today are again actively interested in lumber size control programs. We are finding that yield improvements from two to four per cent are commonly achievable and feasible. How much of this can be recovered is up to the mill, but generally it can be achieved at a minimal cost. What would this mean to a lumber operation producing 100 million board feet of lumber? (See Figure 9.) If we ignore the value of additional chips, focus on increased production and assume a two per cent increase in lumber recovery factor, the additional volume would amount to two million board feet annually, and would have a net value of $324,000.

Next I would like to discuss productivity itself. Productivity is extremely important and is significantly impacted by two items: downtime and delayed time. Downtime is the period when the machine is down due to electrical and mechanical problems. I like to focus on delay time. Delay time is that time when the machine is actually available for processing, but because of problems in mill flow, it is not processing material. Delay time is harder to detect and often frustrating to the operators. Because delays are usually of short duration, they are easy to overlook. We have measured delays in sawmills that range from less than one per cent to over 17 per cent. These delays are caused by such things as lack of material, logs being jammed up at the unscrambler, log handling problems, or surges, downstream delays or chipper jam-ups.

What do these delays in productivity cost? (See Figure 10.) We made the assumption that one could achieve a five per cent reduction in delay time. Since this five per cent reduction is associated with time that can be totally productive, it will result in an increase of five per cent in productivity. There are two ways to economically analyze the benefits of this. One is to look at the cost savings from a more efficient operation as presented next. Assuming fixed and variable costs of seven million dollars a year, we have recalculated the operating costs for this mill after reducing delay time by five per cent. This saved the operation 25 shifts annually. When pro-rated back to a year, we calculated $14,000 in variable costs per shift. Higher efficiency saves the variable costs, and this case would amount to about $350,000 per year. One would like to use the saved time for production, provided logs are available (Figure 11). This would increase production five per cent or by five million board feet, with additional revenue of about $1,125,000. Subtracting the cost of logs, processing, drying, and planing, which amounts to $640,000, we still realize a net benefit of almost $500,000 per year from a five per cent reduction in delay time.

Next, I would like to address lumber drying which can have significant impact on profitability. Generally, we dry to meet the 19 per cent moisture content standards. A general rule of thumb derived by several large companies states that a one per cent reduction in the moisture content, below the fiber saturation range, results in a one per cent loss in lumber value. This is generally the result of increased degrade. We can also derive benefits out of raising the average moisture content from reductions in heat and other kiln costs.

In the following we have analyzed the cost of drying from an average moisture content of 15 per cent down to 12 per cent, a three degree drop in moisture content (Figure 12). The three degree drop corresponds to three per cent decrease in lumber value, and since we are considering a 100 million board feet per year operation at a $200 per thousand price, this is equivalent to a $6 per thousand loss due to degrade. The costs of drying and heating amount to 35 cents per thousand board feet. Additional costs amount to 15 cents, for a total overdrying cost of $6.50 per thousand. This represents an annual cost in excess of $650,000 due to overdrying by three per cent. Shipping dryer lumber results in freight savings of about $1.10 per thousand. These have to be subtracted from the cost. The net cost of overdrying is still in the neighbourhood of $540,000. These potential benefits are the driving force for the development of new kiln control systems.

In conclusion then, the combined areas that I have discussed in relation to a 100 million board foot per year operation suggest substantial savings can be made (Figure 13). In this case, if we simultaneously achieved them all it would amount to 2.2 million dollars annually.

I would like to leave you with one final thought. Expenditures or costs incurred as a result of improving yields or increasing productivity, can generally be readily paid back.

* * *

Figure 1

Manufacturing processes that often can be readily improved

- Improve Log Quality Entering Mill
- Improve Log Allocation
- Optimize Log Breakdown
- Minimize Lumber Size
- Improve Productivity
- Reduce Drying Degrade !

Figure 2

Factors to consider in determining log quality entering mill

- Sweep
- Crook
- Log Length
- Overlength
- Debarking 1

Figure 3

Recovery improvements from reducing overtrimming by 3.6 inches

	Log Volume (cf)	Lumber Tally (bf)	Lumber Recovery Factor	LRF Improvement (%)
Study Logs With Overlength	2847.2	18,222	6.40	
Study Logs Without Overlength	2798.8	18,222	6.51	1.7

Figure 4

Economic benefit from reducing overtrimming by 3.6 inches

Annual Production	100 MMbf
LRF Increase	1.7%
Additional Lumber Volume	1,700 Mbf
Additional Lumber Value	$275,400
Reduced Chip Value	$ 66,300
1,700 x 78 x 24	
2400 x $50/BDU 1	
Net Benefit	$209,100

Figure 5

Analysis showing potential recovery loss in debarking

Log Diameter (in.)	BOF* Yield (bf)	LRF	Difference (%)
6.4	27	7.22	
6.2	24	6.42	11.1

- 6.4 inch log
- 12 ft. long
- 2 in. taper
- split taper log and cant sawing

*based on a target size of 1.875 in. 1

Figure 6

Economic impact of removing 1 inch of wood during debarking

Annual Production	100 MMbf
LRF Increase	2%
Additional Lumber Volume	2,000 Mbf
Additional Lumber Value 2,000 (200 - /12 26/)	$324,000
Reduced Chip Value	—
Net Benefit	$324,000

Figure 7

Potential lumber recovery improvement from correct log allocation

		Small Log Line LRF	Large Log Line LRF	Mill LRF	Improvement (%)
Study Log Allocation	5.51	5.98	5.77		
Optimum Log Allocation	5.64	6.31	6.01		4

Figure 8

Economic impact of proper log allocation

Annual Production	100 MMbf
LRF Increase	4%
Additional Lumber Volume	4.0 MMbf
Additional Lumber Value 4,000 (200 - /12 26/)	$648,000
Reduced Chip Value $\frac{4,000 \times 78 \times 24}{2400}$ x $50/BDU	$156,000
Net Benefit	$492,000

Figure 9

Economic impact of reducing target size by 1/16 inches

Annual Production	100 MMbf
LRF Increase	2%
Additional Lumber Volume	2 MMbf
Additional Lumber Value 2,000 (200 - /12 26/)	$324,000
Net Benefit	$324,000

Figure 10

Economic impact of 5 per cent productivity improvement from reduced costs

Annual Production	100 MMbf
Operation Cost (sawmill fixed & variable, excl. logs)	$7 MM
Operating Cost/Mbf	$70 Mbf
Delays	5% or 25 shifts
Normal Shift Production	200 Mbf/shift
Variable Cost/Shift	$14,000/shift
Variable Cost Savings (25 shifts x $14,000)	$350,000
Net Benefit	$350,000

Figure 11

Economic impact of 5 per cent productivity improvement including added production potential.

Annual Production	100 MMbf
Delays	5%
Additional Lumber Volume	5 MMbf
Additional Revenues	
· Lumber $200/Mbf	$1,000,000
· Chips $50/BDU	125,000
	$1,125,000
Minus Added Processing Costs for Logs, Drying and Planning (5 MMbf x $128/Mbf)	$640,000
Net Benefit	$485,000

Figure 12

Analysis of cost of overdrying from 15 percent to 12 percent moisture content

Annual Production	100 MMbf
Cost of Overdrying From 15% to 12% M.C.	
- Degrade (1% Value Loss per 1% Decrease in M.C. (1% x $200/Mbf x 3% M.C.)	$6.00/Mbf
- Heat - add 104,000 BTU/Mbf (104,000 BTU x $3.33/MMBTU)	$0.35/Mbf
- Other Costs	$0.15/Mbf
Unit Cost of Overdrying	$6.50/Mbf
Annual Cost of Overdrying	$650,000
Freight Savings Due to Shipping Weight Reduction ($1.10/Mbf x 100 MMbf) Shipping Rate $4.45/cwt	$110,000
Net Cost of Overdrying	$540,000
or	
Potential Net Benefit	$540,000

Figure 13

Summary of potential economic benefits from six areas for a mill producing 100 MMbf annually

Elimination of Overlength	$209,100
Improved Debarking	$324,000
Improved Allocation	$492,000
Minimum Lumber Size	$324,000
Reduced Delays	$350,000
Eliminate Overdrying	$540,000
Total Net Benefits	$2,239,100

Current Trends in Log Preparation

Roar Thorsen
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I am most honored to be part of this seminar in Prince George, although I wonder if my little talk can impart much to all the experts gathered here today, both the audience and the various speakers.

The name of the seminar is Microelectronics but I am afraid that I will not be able to go much into computers and electronics. I remember a comment given to me many years ago by an old sawmill manager I visited. Upon my question on how his mill was working that day, he answered that it is now working very well, "We threw out the electronics yesterday!"

However, electronics and computers are here to stay and we will see a fast and steady increase of this in all departments of the mills from logs to finished products.

My brief presentation today concentrates on handling and preparation of logs, from the forest to the headrig. I have mixed discussion of British Columbia with Scandinavia mills in order to show similarities and ideas from both sides.

Some of you have been on tours in Scandinavia and I am, as you know, running yearly tours in British Columbia with Scandinavian mill personnel. It is always interesting to conclude that both sides have a lot to give to each other; it is merely a matter of adopting the ideas and philosophy to the individual conditions and local systems. It should be mentioned here that some Swedish mills are currently cutting CLS lumber on an experimental basis. This lumber is sold in the U.K. and could create some threat to Canadian lumber manufacturers.

When asked to make a speech on the subject of handling logs I chose to call it Log Preparation.

All of our sawmills small, large, old, new may be well built and well run and aiming for each individual's optimum recovery. However, the initial important factor is that no mill will be fully successful unless the best possible prepared logs are fed in. Too often one observes in the mill downtime reports that one of the main reasons for stoppage is 'no logs'. Part of this can be related to mechanical problems, but a large portion of this reason is due to the condition of the logs which cause hang-ups on decks and conveyors before they reach the headrigs. In order to evaluate these problems and produce some ideas for individual consideration, I would like to start this presentation at the source, namely in the woods.

Preparation of logs is a continuous chain from the standing tree until the log hits the saws. There are many links in this chain which are all trying to make problems for the mill, but if observed early and properly dealt with, many of them can be corrected and together help the mill to work at its optimum capacity.

It is too often observed in many companies that there is lack of communication between the logging division and the mill itself. Both sides often blame each other and very seldom can one hear that the mill works closely with the logging, be it company or contractor loggers. Very often it is a matter of passing the buck to the next link in the chain. Many logging methods are best for the logger but not necessarily for the mill. During some forest visits, it is often observed that trees are felled flush with ground level, since this makes it easier for the logging machines to maneuver. However, when these heavy flared butt logs arrive at the mill, big problems are created. Current delimbing procedures can also cause hangups on decks and in conveyors.

British Columbia is handling a large number of individual species when taking into account both coastal and interior regions. However, since we now are in Prince George, we will only concentrate on interior species. Most mills are S-P-F which is a way to

get away from species segregation. Some mills cutting for export are separating species on the customer's demand.

Scandinavian mills mainly handle only two species, spruce and pine, which are kept strictly apart for many reasons. A few mills are cutting birch. The spruce and the pine are not exactly the same species in B.C. versus Scandinavia. The pine in Scandinavia is called Scots pine.

It is interesting to note that in my recent discussions with Ikea Ltd. they, in their critical search for Scots pine, have approved the Lodgepole pine in their furniture manufacturing plants in North America.

When it comes to drying in the slow and careful way like in Scandinavia, spruce has 10 to 15 per cent shorter drying times than pine. Pine sells on the European market for prices approximately 40 to 50 per cent more than the spruce in the high grades. These facts, coupled with old tradition, are the main reasons for specie segregation in Scandinavian mills.

Sweden is increasing its planting of Lodgepole pine. Cones are imported to Sweden from Prince George. The Lodgepole pine can be logged 20 to 30 years earlier than the Swedish pine.

Logging methods are different in various areas in B.C. For the typical large coastal tree, the only felling tool is a large chain saw, whereas the B.C. interior shows more variation in tools employed, from chainsaws to hydraulic shears.

B.C. Interior trees are very similar to those in Scandinavia, both in diameter and height.

Our forests are mainly owned by the Crown. We all know that this could mean a few complications. A similar distribution in Sweden would show state 25 per cent, large companies 25 per cent, privately owned 50 per cent. The last item often creates problems when it comes to price setting of logs and taxes. One friend of mine, who is a forest owner, often says, "Why cut down my trees and sit with a tax-note in my hand. Better to leave the tree in the woods". This is unfortunately one of the reasons why people say Sweden is 'running out' of raw material.

Forest fires are trying their best to create problems for our logs. B.C. has a larger loss to fires compared with Scandinavia. Beetles, budworms, bugs, etc. are big troublemakers both here and in Scandinavia. Millions of dollars are lost to these enemies. Fungus is another troublemaking item, which struggles to break the tree down. Sweden, although only half the size of B.C., has a larger number of moose than B.C. causing damage to the planted forest every year.

The hydraulic shear has been for some years our most common logging method. Many new ideas are constantly being tested. However, much damage is done to the butt end of the log which often is not detected until after kiln drying when the cracks open up. It makes the felling capacity effective but the resulting damage is often neglected by the logging operator. Chainsaws and circular saws show an increase in usage since they do not cause too much damage to the tree during the felling.

A typical method in Scandinavia is mechanized thinning and loading. These are bucked to three meter length for pulp logs. The Scandinavians are often shocked when I show them the flail delimber at work in B.C. However, this is an economical system although it creates hard work for the mill barkers and creates a large amount of waste and clean-up work in the mill process. A typical Scandinavian delimber is mounted on a mobile rig handling one stem at a time and bucking to length with a chainsaw. This method causes no damage in the cut. Manual felling and bucking is still the most common sight in Scandinavian woods. Manual delimbing is also most used. The Scandinavians want the logs to be completely cleaned when they leave the forest.

Sweden has approximately 3,200 mills, of which 500 have a production of five MMFBM and over. Only a few mills bring tree length stems to the mills. Trucks require special permits to drive on the highways, due to the large overhang. The typical B.C. logging trucks with loose trailer at the end of the bundle are not yet in use in Scandinavia.

In a typical receiving station at a Swedish sawmill, trucks arrive at a bundle scale station where the size of the bundle is measured. They do not use weight scales. The number of stems per bundle is counted at this checkpoint at the entrance to the log yard.

A very common sight are Scandinavian trucks loaded by its driver. Bucked logs are sold and delivered at roadside. Piles are separated in sawlogs and pulp logs. Some companies also demand that purchased logs at roadside are separated by species (spruce, pine, birch).

Logs are bucked to sawlog length in the woods. Small logs and tops are loaded onto other trucks which go directly to a pulp mill woodrooms. All Swedish pulp mills have their own pulp log woodrooms (three meter logs). The small amount of chips from sawmills comes from sawmill waste chippers.

The length of B.C. and Scandinavia loads are the same, 24.0 meters overall (about 70 to 80 feet). The Scandinavians are handling two, three or four bundles per truck.

Unloading of trucks is faster in B.C. with tree length bundle. A good trend here is the increasing usage of strapping the loads before they are put in storage. Some mills report 10 to 15 per cent gain in recovery since breakage and dropped logs are practically eliminated.

Unloading a Swedish truck is slower due to handling of two or three bundles per truck. On the other hand their bundles are more uniform and easier to handle due to shorter taper. Almost all Scandinavian log yards are paved to protect the logs and save mobile equipment. No broken logs can be observed in any of their yards.

Portal cranes are increasing in popularity. The log storage can be more compact due to high storage. These cranes are excellent for unloading trucks and loading decks. Tests have shown that these are so maneuverable that they can pick up single logs with the grapple.

Bucking of logs is getting more and more developed. Single log linear bucking is still the most used method and also lowest in investment cost. Many mills are introducing merchandizers with multiple saw bucking which enables optimum bucking with high capacity. These types usually mean high investments. Other methods of bucking is stationary chain saws which are mainly used on the coast with large logs. It can also be mentioned that a new bucking system using an industrial laser is not as far away as many think. I was shown such a unit which will cut two foot logs at one foot per second or 60 FPM. This unit is currently under testing in a laboratory in the Vancouver area.

Log conversion varies with each industry. Some integrated mills are bucking for saw logs, pulp logs and peeler blocks which all adds to the complexity of the log preparation. An optimum bucking program often assists the operator in his selections. Most patterns have some waste, mainly due to the mill's normal (60 centimeters) two foot increments in length. A prebucked Swedish log direct from the woods also often shows some waste. However, Sweden cuts with (30 centimeter) one foot increments which helps with the recovery. It can be mentioned here that Norway cuts with 10 cm increments (four inch).

A typical incoming bundle shows a mixture of small and large logs and mixed species. I have mentioned species separation earlier and would like to say a few words on the sorting of logs as part of the preparation.

One of our clients did not want to build a log deck for feeding logs to the mill, so we used a heel-boom crane which picked logs up individually. Logs were placed on one of the two infeed conveyors on each side of the crane. Unwanted logs could be put back in another bunk for return to storage. The mill has kick-outs and re-entry for bucked logs in case the crane is down.

A simple, low cost idea of infeed is used in many Swedish mills of medium size. A small travelling crane puts logs on the infeed conveyor between rails. The operator can select logs during feed. He can also separate species and put unwanted logs aside. A typical picture from a Swedish log sorting system shows the log scaler sitting in a 'living-room' atmosphere and selecting species and grades. Log diameters are scanned. Logs usually have three grades per specie. This is a government operator and not employed by the mill.

In Scandinavia, log scanners are used in every sawmill of any size. Nobody would ever consider going back to visual measurement of logs. Scanners are used for diameter measure before sorting and also for volume control at the infeed to the sawmill. The results from the input volume control is compared with the tally at the green trimmer outfeed to get a constant recovery result. Scanners are also used for setting of chipping heads and saws for logs and cants.

The log sorter at Gruvon Sawmill, built by myself in 1966, is still in full operation today with not many changes. The sorter contained the following bins:

Pulp logs

Metal logs (logs with embedded metal)

16 Pine

16 Spruce

Overlength at end of each specie

Total: 38 bins

Sorting speed was 300 FPM and normal capacity was approximately 8,000 logs per shift. Sorting was to one-half inch increments on top diameters. Twelve foot average log length plus a three foot gap equals 20 logs per minute which equals 1,200 logs per hour, seven hours per shift effective time.

A typical Swedish log yard shows sorted logs ready for infeed to the sawmill. Blacktopped yard and well organized rows of sorted logs assures effective sawing with high recovery and little log losses. A form of log sorter in simple version shows logs diverted to several decks as diameter groups prior to sawing. This saves part of setting time. Many mills in B.C. are using this system.

A system used in Scandinavia for many years is the cylindrical reducer in combination with barking. The

purpose is to remove all flare butts thus making log handling easier on following decks. Such units can be made with fixed or variable openings. Mills report four to five per cent increased capacity after installation of such units.

Automatic storage decks are often used in Scandinavia between barker and sawmill. These decks even out disturbance in the flow without affecting both departments at the same time. The first deck of this type is now installed at Polar Forest Industries in Bear Lake, B.C., designed by our company.

A typical handling of logs into the sawmill in a Scandinavian mill is to turn all logs so that the top always enters the saws first. These log turners often help in the layout of the mill flow, making the infeed more flexible in location. Top end first gives the best recovery since the log cutting pattern is based upon top diameter. A sensor feels top or butt end, which via impulse activates a kicker for left or right kick.

An example on log handling at a sawmill can be seen at Procter & Gamble Cellulose Ltd. in Grande Prairie, Alberta, where we did a rebuild project for the infeed to the sawmill. This system was originally designed for average 1,300 stems per shift. The mill was starving for logs. The first change made on the tree length deck changed the capacity to 1,600 stems per shift average. After changing to the new infeed decks for bucked logs, the capacity is now 2,400 stems per shift on average. The sawmill is now getting almost too many logs. One operator makes manual selection of bins and kick-outs. There are three kick-outs for pulp logs and oversized logs.

A scanning system on the slasher deck and on the infeed to the canters measures the infeed volume. The first deck leads to the left hand barker, the last deck to the right barker, while the middle deck goes to either one via a diversion gate. Logs under six inches in diameter go to the pulp log bins, automatically guided by the scanner.

A different type of log sorter is in use by Swedish Cellulose Co. at their log terminal outside Sundsvall. All logs are delivered to the terminal by railroad.

Single logs pass by the sorter operator. Logs are sorted to destinations (sawmills, pulp mills). Logs are carried on arms, similar to a J-Bar sorter for lumber. The log sorter is built indoors. The company has two of these, both built in 1966-68. Each handles 2,000 logs per hour.

Logs are dropped into 'railcars', twelve in total. Each car is remote controlled for removal or replacement. The walls have expandable sides. Scrapers are located under carts to floor openings for waste fallout.

Bundles are removed from carts with front end loaders. Bundles are reloaded on trucks for destinations to sawmills and pulp mills. The same type of log sorting system could be used for sorting of saw logs only.

A last station or preparation of logs before sawing is the reducer or chipper canter. When used properly this type of unit does wonders for a mill since flares are eliminated and no bad slabs are developed.

The main purpose for prehandling logs is to allow a maximum yield in the sawmill. Logs are getting more and more expensive and we must all work hard for maximum recovery from each log without having to increase the number of logs for the mill.

Finally, I would like to mention some extracts from recent articles published in the press:

"A political person said recently that Canada is quickly running out of marketable timber. Rapid action is needed to protect our industry and its employees. Canadians are largely ignorant of the importance of the forest industry. Every year Canadian forests are reduced by one million hectares through logging and nearly one third of that is not replanted."

Prince George Region Development Corporation in the October 1983 issue says in their chapter on forestry:

"The Association of B.C. Professional Foresters estimates that the B.C. Forest Industry replant is less than half of the wooded area it lost each year. More than 800,000 hectares are harvested annually, but less than 25 per cent are planted or seeded.

The Prince George Forest Region has had a record tree-planting season. A symbolic 40 millionth tree was planted about 50 kilometers east of the city. This total represents nearly double the seedlings planted in the region last year and one-third the Provincial total."

I would like to express my admiration and congratulations to Prince George foresters and I am sure that you all will contribute to maintaining Prince George as The Spruce Capital of the World.

All we need is to handle our logs to the best benefit for individuals and for the province. After all, 50 cents of each dollar comes from our forest industry and B.C. will undoubtedly continue to be one of the world leaders in forest products.

Finally, I would like to show the following chart, obtained from one of the large consulting firms, showing percentage distribution of lumber and byproducts, from the total tree:

From Total Tree	1
Top	14
Breakage	14
Stem	52
Stump	20
Total	100%

Lumber and By-products from Stem	
Bark	9.0
Defects	4.0
Sawdust	10.5
Shavings	9.5
Total Waste	33.0
Chips	26.0
Lumber on Railcars	41.0
Total	100%

It is obvious that careful handling of stems and logs will help the mills to higher recovery.

* * *

Headrig Technology - Present and Future

Dennis Oldknow
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Bearing in mind the theme and location of this seminar, I thought that it might be useful to look at some of the theory, software and hardware involved in making a shift from a current interior equipment, to the use of so-called "high recovery headrigs". So I have put together a few thoughts on the state of the art as I understand it and where I think we might be headed.

We've all heard about the recovery factors of nine to eleven or more quoted as a result of computer studies such as the Best Opening Face Program and these sound wonderful compared to the recoveries of six or so that we are getting in the interior. Unfortunately, we are sometimes comparing apples and oranges.

The theoretical results are based on recoveries from straight, round logs entering the headrig and also on the assumption that the edger and trimmer optimizers would achieve perfect results downstream. To make the figures comparable, we really have to take into account the losses that occur due to log quality and in the yard, bucking, edging, trimming, drying and planing operations. After doing all that, the gap between present and possible is narrowed quite a bit. In addition, recovery from our larger logs suitable for high recovery rigs is also higher than our average number we are using at present and this even reduces the gap some more.

We also have to remember that the headrig consists of a number of important components, the main ones being scanning, optimizing, positioning, transporting and sawing. Improving any one of these can improve recovery. A big portion of a potential increase can come from better basic sawing.

Some years ago, I was studying the replacement of a sharp chain quad by a proposed end-dogging system in a Montana mill. Out of interest we asked the quad operator to simply slow down to the speed that an end-dogging system would run at. When he did this, he had time to position the logs on the chain in better orientation and got a substantial recovery improvement.

Sometimes the biggest improvement and fastest payback comes from improvements to the present system, particularly for larger logs and a simple product mix. This can shrink the benefits from replacement and a complete new headrig may not be justified, particularly if foundation and building additions are required.

A third consideration is the actual value of the lumber that is obtainable through the use of high recovery techniques. Many Chip-N-Saws are live sawing in a single taper orientation as shown in the top view of Figure 1, at least up to the point of generating ten inch lumber. This has the effect of producing the maximum amount of wide lumber and the minimum piececount in the mill. Going for maximum recovery, as shown in the bottom view, usually means generating side cuts to get the benefit of the taper in the side of the log and this means more pieces. If there is a bottleneck in the trimmer now, additional small pieces could result in a reduction in overall production.

In high recovery milling we sometimes ending up getting more lumber from the outside of the log. This might be in the form of short, narrow lumber or one inch material and there maybe some reduction in grade due to extra wane. So we have to very carefully assess all of the factors involved such as: What are the effects of a change in lumber size? Do we want to make one inch? Will there be an effect on grade? Production? Average mill net? Or profit?

To summarize what I've outlined so far, it seems to me there is often less improvement possible than it may appear at first glance and a very careful study should be done on the overall effect before embarking on a replacement program. Also, only a portion of the

improvement can be attributed to the process control system while the remainder will be a result of better handling and sawing.

While the process control system is only one part of the headrig, it is still extremely important because very small differences in positioning can make a very big difference in recovery. As you can see from Figure 2, very small difference in offset play a big role. Very few people live saw like that now but it does illustrate the point. Also the errors in each part of a headrig are to a certain extent additive so each part must be as accurate as possible.

The addition of simple, basic scanning systems has given a tremendous boost in recovery to our small log headrigs but the next steps in improvement will not be as easy. Because of this, it is necessary if we are going to get the benefit of the advances in scanning and computing to get very picky for us all to thoroughly understand the task.

Having tried to put the size of possible gains and the difficulty of the task into some perspective, I am now going to underline some of the theory. I caution you that some of this is a mixture of my own theories combined with conjecture, and if you agree with with all of it, I will be surprised. Incidentally, I am refering to recovery in this discussion, but the same principles apply if sawing for value and profit. Also, I am using Imperial units because reference material is in Imperial.

Let's explore the difference between theory and reality a little by looking at some of the results of the well known and often quoted Best Opening Face Program created by the U.S. Forest Service Madison Laboratory. The objective is not to downgrade this excellent work, but rather to illustrate the diffculty involved in translating theory into practice and to show how the results must be used with care.

The development of the Best Opening Face Program made possible a systematic analysis of various sawing alternatives. This program finds the sawline positions which theoretically result in the maximum yield for any specific log. By specifying all the conditions and using the program on a given range of log diameters, lengths and tapers, the best theoretical breakdown patterns can be determined.

In 1976 the Forest Products Lab at Madison used this approach to determine the best volume yield for a total of over 3,500 different log shapes and diameters. Although there were a total of eight different log sawing patterns examined, unfortunately our typical interior CNS horizontal live sawing was not one of them. The two of most interest to us today were variations of two main approaches. These were split taper, where the log is sawn parallel to its vertical line, and full taper, when the log is sawn parallel to one side. In all cases it was assumed that a center cant and one or more side boards could be produced if this were required for best yield.

Table 1 shows the results of the study that indicated that shorter, low taper logs were best sawn full taper, and that longer logs with more taper were best sawn using split taper. Full taper sawing has the potential to yield more side lumber since all the taper is thrown to one side and the possibility of recovering short lumber from this taper is increased. However, this is more important in the shorter logs because in the longer logs, even though the log is sawn split taper, there is sufficient stock in each half of the taper to yield side lumber. When logs are sawn full taper, a cant is produced which tends to have one sawn face nearly equal in width to the full length and the other face substantially different in width from one end to the other. From a cant like this the lumber recovery will be lower than from a cant produced from a simple log sawn split taper.

In the shorter, lower taper logs, the loss in recovery from full taper cant is apparently more than offset by the increase in side lumber recovery. In longer, higher taper logs, the difference in increased side lumber recovered from the log by the full taper method is reduced. At the same time the losses in cant recovery are increased and the overall result is a change in favor of split taper sawing.

The results from sawing logs representing several diameter distributions are shown in Table 2. The column Original Study Logs is a theoretical distribution of one log in each diameter class and has no relationship to reality. Log distribution 3 is a typical Interior log supply and there is a figure at the bottom showing best total. This shows a figure of 15,209 board feet and represents the best results based on being able to saw each log individually in the manner which would result in the highest yield. The two figures above this show what would happen if we were to saw all logs split taper or full taper. According to the study, sawing all logs split taper would result of 98.69 per cent of the best possible and sawing all logs full taper would yield 99.49 per cent. The difference between those two methods is therefore only 0.8 per cent in favor of full taper sawing. These results have been quoted a number of times as the justification for full taper sawing in small log applications.

We now have to bear in mind that these extremely small differences are based on perfectly round, straight logs and were also based on recovery, not value. The critical factor in real life is whether the equipment and the operator can actually achieve the desired end result and even with equipment capable of higher recoveries such as the end-dogging system, consideration of the actual shape of the log is critical.

Figure 3 shows a situation where sidecut is being produced while double taper sawing. There are three circles shown there representing the top end, the butt end and the mid-section of a 16-foot log with one inch of sweep or crook leaning to the right horns down. The inside piece of lumber that I've shown represents a one by four sideboard in a minimum-opening face position based on the assumption that the log is straight. I will refer to the face that the board is being sawn from as the full taper side in the figures subsequently described.

You can see that the line representing the mid-section of the log cuts through the board. Whenever we are looking at cutting patterns, we have to think about this. The log sweep does not have to be at such a big angle from the vertical to cause heavy losses when full taper sawing.

Figure 4 shows the sidecut generated from a very straight log where good recovery is achieved by full taper sawing. The piece on the left-hand side is from the full taper side of the log that shows a full length minimum-opening face. The piece in the middle is from the opposite side of the log and the piece on the right is from the oustide of that. By sawing full-taper in this case we have generated a potential piece of usable lumber in the right-hand piece. If we had sawn split taper, the face on the right-hand piece may have only been half as long. Also if you look at the bottom face on the left-hand and center pieces, you will see that they are roughly equal, so we can expect reasonable recovery from the center cant.

Figure 5 shows the sidecut and center cant generated from a log with a bit of sweep which has been sawn full taper again but with the sweep leaning slightly towards the full taper face. The full taper piece is on the left-hand side and you can see that the face goes from narrow to wide to narrow again. The second piece from the left was also cut from the full taper side of the log. The third piece from the opposite side has a face at each end, but the middle is useless. If you compare the width of the bottom face with the piece second from the left, with the bottom face with the piece third from the left, you will also see quite a bit of difference in widths. These two faces are the same as the two faces of the cant, so recovery from the cant will suffer also. In this case, we have probably made no gain in sidecut from full taper sawing and we have probably lost recovery from the center cant as well.

In Figure 6 the opposite has happened. The log has been sawn with this very small amount of sweep leaning away from the full taper face which is on the left. This has caused the piece to wane out in the middle and the whole piece is probably lost. So we have gained half a length from full taper sawing. We have lost a whole length in the process. If we had sawn split taper in this case, the piece on the left might have ended up full length. The headrig operator in this mill was located at the side of the in-feed and he couldn't possibly see whether the sweep was in the vertical planer or not.

From all this you can see that it is very difficult to position and mill a log perfectly. It is difficult to determine where the opening face should be for a nonperfect log. Because of all of this I think we have to question whether the results of computer studies which favour one sawing method over another on the basis of extremely small differences in yield can be used with confidence in light of our relatively crude present headrig technology.

It may become necessary for us to start using probability in our mill technology. One cutting pattern might be slightly better than another in theory, but might result in more severe losses than the second best solution if precise positioning is not achieved.

In any event, I think we have got to start considering the capabilities of our machine centers and real logs in our theoretical studies, and very few computer programmers have the required experience. A computer alone cannot predict how well one system will perform in comparison to another in terms of actually achieving the desired end result.

It seems to me that we will only achieve maximum yield from a log when we achieve three axis control (Figure 7). First we have got to have control over the rotation of the log about its longitudinal axis to allow for sweep, crook and ovality. Second, we have got to be able control the pitch of the log, which is movement in the vertical plane. Thirdly, we have got to be able to control the yaw, which is movement in the horizontal plane.

These three movements are essential in order to get the best position possible for the cant. However, if we are also producing sidecut, there are even more reference lines involved (Figure 8).

Even for a perfectly straight, round log, there is a difference in the ideal manufacturing axis simply because of the taper in the log. This assumes that the bottom face of the log would be the cant processing line as would occur in the Chip-N-Saw for example.

A defective log could require a number of processing axes (Figure 9). Here there would need to be a separate processing line for the cant, for the near-side sidecut, for the far-side sidecut and even the piece of lumber from the top of the cant and the piece from the bottom of the cant. I am not aware of any headrig which achieves all of this in a single pass.

How important is it?

Figure 10 shows the effect of a slight adjustment in processing axis of a cant from a small log. The result is a 15 per cent jump in recovery and also better lengths.

After discussing all of those different axes for each piece generated from the log, it becomes really difficult to represent a cutting pattern with a single cross-sectional view of the log, because some of the lumber indicated in Figure 11 would be sloping vertically or horizontally. So the rectangles representing the lumber could really only be true for only one cross-section of the log.

Another important processing adjustment is the amount of offset required. Once again, studies on straight, round logs have indicated the benefits of side-shifting when sidecut is being produced. Now some of the more capable computer programs are showing that the ideal offset varies with the amount of sweep.

Now that we have discussed some of the theoretical requirements, let's have a look at some of the developments in scanning and computer control to see how it measures up.

First, we have to decide if we are even scanning the geometry of a log adequately. Figure 12 shows two shapes in black - a circle and a triangle. The vertical and the horizontal lines represent two axis scanning. You and I can tell the difference, of course, but the computer has to assume that those two shapes are the same. This two axis scanning may be adequate for a Chip-N-Saw, but it is not adequate for high recovery techniques. Even some of the latest end-dogging systems are only scanning in two axes using vertical and horizontal curtains. This problem is being recognized and scanners which can evaluate the shape of the actual log and where it is in relation to the cutting elements are on the way. After scanning, the computer has to determine the geometry of the log and decide how to saw it.

Simple process control systems have based cutting decisions on diameter, taper and length, with single axis scanning and no consideration of sweep or other defect. Once again, this may be adequate with an inadequate field works. More complicated versions have based cutting solutions on the theoretical fitting of various truncated cones within the actual geometry of the log. The shape of the cone has then been used with Best Opening Face Programs to select a cutting pattern from the look-up table in the memory of the computer.

From the ultimate recovery viewpoint, these cones do not necessarily provide due consideration to the actual shape of the log and the various processing axis which I have talked about. However, we are now seeing some progress in the development of real time programs which do give more consideration to the actual log shape and which can prepare a custom unique sawing solution for each log. Many people can pick an item of clothing off a rack by size only and have a satisfactory fit without some alterations. The same thing applies to logs.

These real time programs can eliminate the annoying problem of regeneration of look-up tables. This is not a big thing in the Interior because of the simple, relatively stable product relationships, but it is valuable when getting into exports. The features which are valuable for the Interior are the ability to get a closer fit to suit the log and the ability to change the program quickly to adjust to mill conditions or excessive wane, for example.

The development of real time programs has been really difficult for sweepy logs because it involves the development of a Best Opening Face position in two axes. This can involve thousands of computations for just one log.

Even the end-dogging systems have, up to now, been generating sets without giving due consideration to this. The chipping of the bottom face has really only been a minimum opening face generated from materials handling reasons. These chipped bottom faces are therefore not a true reference for optimizing the cant. Computing time has been a major problem. I am told that this problem has just about been licked however, this applies only to a log which has been rotated by an operator to what he feels what is the best position for optimum recovery. We still, apparently, are not yet at the point where we can scan a log and then do all of the calculations which are necessary to determine the optimum overall orientation of the log relative to the cutting elements.

So we are still in the middle of what I call the Geometry Revolution, and before we are out of that another series of challenges is arising. This is the next stage in scanning, that is for defect. Once again, this is a bigger problem on the coast because of the importance of clear and shut recovery from the more expensive logs there. Small logs on the coast are frequently the tops from large trees and can have very large knots and other defects. When positioning these logs to minimize the impact of defect, I found this can be the worst possible location in terms of overall geometry. It then becomes very difficult to decide the best way to saw them. Those two things are fighting one another. Scanning for defect is in a very preliminary stage and I have introduced the subject here only to illustrate the depth of expertise that will be necessary to develop for fully automatic systems in the future.

There are even more challenges when attempting to determine the optimum way to saw a log. As part of the process of determining the optimum sawing pattern, it is necessary to assign values to the pieces of lumber in that pattern.

With good quality logs, this is less of a problem. You can assign mill values to the sizes and lengths shown on the cutting pattern based on grade mix experience, subtract various allowances for planing or other processing costs which may vary substantially based on lumber size. You may also apply penalties to small sizes which might choke up the back end of the mill. After doing all that, you may end up with a reasonable assessment of the value of the log.

With poor quality logs, you'll end up with a much higher percentage of trim-back and reman material and the final distribution of lumber could be substantially different from the one that you thought you'd get. Even after getting everything right, it is possible to end up with a yard full of optimized lumber that you can't sell.

The problems I have described are minimal if you are cutting a basic line of dimension, but when a mill accepts an order for an unusual size for export, for example, there can be disastrous results if care has not been exercised and too much falldown results.

The actual result is invariably different from the theoretical. Mills operating small log rigs on the coast have found it necessary to have a bright, experienced person evaluating cutting patterns in conjunction with the mill staff to try to project actual outputs and the effect on the mill flows.

The problems of geometry in sawing that I have described can make a person very cynical. A lack of confidence in the ability to realize computer generated predictions has led to a number of completely different opinions on how to saw a log.

For instance, one school of thought says you should completely ignore the theories such as Best Opening Face and get the best possible center cant. This applies particularly when you are cutting a particular export order where the high value export item may only come from the cant.

Another school of thought says you should go one step further and saw a log with the sweep horizontal instead of vertical to achieve a parallel cant and to disregard the impact on sidecut. This philosophy is being practised in the coastal mill, but on larger logs than you are handling, though.

All of this emphasizes the point that we have got a long way to go before we can say our process control systems are perfect. Indeed we don't even know at this point if there will be economic justification in perfecting them. This may be the ultimate case of spending more and more to chase less and less.

There is no question that the systems which have replaced manual decision making in our present equipment are undoubtedly justified. However, judgment and monitoring is necessary to achieve the best results, and as we develop more complicated systems the human input required is likely to initially be increased. When scanning systems are eventually perfected, both for geometry and defect the human input may taper off, but this will be a long time coming.

Now that I have discussed theory and process control, let's take a look at some of the mechanical considerations and options.

In addition to the three axis control that I talked about earlier, Figure 13 shows some other features that would ideally be incorporated into the ultimate headrig. First we would like to have the ability to split taper or full taper saw individual logs depending on actual log shape. Secondly, we would like to be able to offset the log in relation to the source in order to optimize the sidecut. Thirdly, we would like to position to the Best Opening Face in vertical and horizontal planes. Fourthly, we would like to have the flexibility to vary the thickness of the cant to produce the most valuable output.

For small logs up to, say, seven inches in diameter you can run into problems when trying to end-dog or side clamp because of the flexing problems of the log, so for dimension lengths anyway, we will probably be using our present Chip-N-Canters for a little while. In these size ranges we don't have a choice between switching from split taper to full taper for individual logs. We have got to select one or the other.

Figure 14 shows the geometry problem of full taper sawing. As you can see, the top diameter of the log doesn't even fit within the butt diameter on the processing axis, so there is an inherent loss factor. Also, from a theoretical point of view, there is no gain in full taper sawing unless you produce sidecut and you may in fact lose recovery from the cant. The argument in favour of full tapering feed for these logs is that at least the log is pressed against two reference faces and you have got a better idea of where it is in relation to the chipping heads than when using the standard in-feed. The standard in-feed also tends to produce only one complete face along the bottom of the log and the incomplete faces along the side of the log have caused sniping in mills using downstream twinband breakdown. Full tapering feed results in two references faces at right angles to each other.

It seems to me, however, that the standard in-feed must be so bad in its ability to position and hold a log throughout the cut that it is being replaced by something which is inherently poor in itself. An advantage with split taper sawing on logs which are not straight is that by aiming at the centerline of the log you could stand a better chance of fitting the intended cutting pattern into the log's geometry. For that reason, I believe that some improvements could be made by using log turners and improving our split taper in-feed designs.

This is the relatively new stretched Chip-N-Saw in-feed that you might not be familiar with yet. One of these is being built for a mill in the southeast United States. The idea is to first rotate the log into the best operator decided position with a log turner as it passes through the first of two scanners. That in itself seems crazy, but anyway, the next step is to chip a guide on the bottom of the log before passing the log through the second scanner which is shown in the middle there. The second scanner finds out where the log is actually located relative to the main chipper heads and the chipper heads are then set to suit the true log position. This feature might result in improved recovery I think it will and is based on split taper sawing.

We are still left with the problems of trying to line up the optimum milling axis and this lineboard type of feed system will remain a compromise solution. Not many mills have the space to retrofit this stretched version. I do think, however, that improved versions of the split taper in-feeds are possible, and will perhaps form the next step for a number of mills on smaller logs. For large, straighter logs, the losses due to full taper in-feed geometry are probably less important, and for the larger, straighter logs, the full taper in-feed may remain the answer.

When moving past say, eight inches diameter, the question of high recovery headrigs comes into play. Two obvious factors working against high recovery headrigs at present are the lower throughput capabilities of the system, although that's being improved and the obvious general lack of funds. There is not much we can do about the funds situation, but a decrease in throughput capability can be overcome in some instances if there is a sufficiently large increase in recovery or value from the given log supply.

I have explained some of the theoretical reasons why recovery should be better from high recovery rigs than from our Chip-N-Saws. This theory has been substantiated by a number of industry studies.

Figure 15 is a chart showing the results of a test made by Weyerhaeuser some time ago. It shows the recovery from a group of reasonably straight logs, eight inches diameter from eight to twenty feet long. It shows the actual green recovery of from the average of six Chip-N-Saws in red versus three quads in green. As you can see there is a substantial difference in favour of the quads. Weyerhaeuser set about trying to find the reason for this and eventually they tested logs through Chip-N-Saws and found the enormous impact of sweep or crook.

Figure 16 shows the results. The information is not confidential. It shows a tremendous drop in recovery with increasing sweep. From 7.50 sweep down to 4.5 at three inches of sweep in a sixteen foot log. The result was the obvious conclusion that the Chip-N in-feed could not hold a sweepy log in position necessary for best recovery while the quads did a better job. We also have to do a certain amount of oversizing on our Chip-N-Saw cants so that we can clean up chipped faces and so on.

Now while the early quad band installations tended to do a better job they were still less than perfect. The ducking-dog or pointed chain in-feeds permitted the placing of sweep in the upright plane, but there was very little control over the positioning of the log relative to the saws and the in-feed permitted the log to roll toward the side where the saw was taking the largest bite. This rolling action resulted in propellor shaped cants and sidecut which was typical of many early installations.

I have spoken mainly about sweep up to now but this of course a log could be a problem for positioning because of crook or large branch stubs or butt flare for example too.

In the development of the quad concept at St. Regis in Libby, Montana some years ago, the log was first placed on the in-feed chain and then carried through the scanner on the way to the saws. The saws were then set to suit the actual position of the log on the chain. This was a slight improvement, but it still did not address the problems of rolling in the cut, providing offset or full taper combined with split taper sawing. This concept is now being used in the stretched Chip-N-Saw.

These problems led to the development of the end-dogging carriages which were first introduced in the States in the early 1970's. These provided the means of locating the logs in any desired location relative to the cutting elements and from that moment on the challenge from a recovery viewpoint came, and remains, mainly one of scanning in determining the actual position of the log and the sets.

Unfortunately, the in-feeds of these machines are being built backwards.

At the moment we are still relying on the operator to rotate the log into what he feels is the best position for recovery and after that the log is usually passed through scanner curtains on the way to the saws. From an optimum viewpoint, we should be scanning the log before rotating it to its best position. This hasn't been possible up to now, partly because of the multitude of calculations necessary and because we haven't had a scanner that could do it, but I notice that a mill in the United States has recently announced that it is achieving some variation of this.

Slightly behind the end-dogging system in recovery and possibly still ahead of it in throughput is the side clamp system. In between these and the Chip-N-Saws are a number of headrigs such as the sharp chain twin band. Also there is the continuous end-dogging system which uses over and under endless chains. On the unit at Roseburg, the pusher dog is on the bottom and the resistor dog is on the top chain. There are versions of this where both chains run side by side in the bottom chainway.

In all of these intermediate solutions there are losses of the ideal positioning or holding features which are necessary in the ultimate machine. The loss of these features is more or less important depending on the size and shape and straightness of the log. A very careful analysis together with a lot of judgment is required to evaluate each one.

There are two ways to approach this. The first way is to ship a load of logs to a mill which has the type of equipment you are considering and to make a judgment allowing for the other differences in mill equipment, personnel and procedures which would still exist. This has been done and it does reduce a number of variables which have got to be considered.

The other way is to work from first principles using cutting diagrams together with a lot of judgment and this is the process most frequently used. This is also the process which demands the most knowledge and care. It not only requires the knowledge of logs and lumber. It also requires the knowledge of how well combined mechanical and electrical systems achieve the desired result. This difference between theory and reality can be very difficult to assess, but is the most important single factor in making an assessment.

When analyzing how much better recovery a factor might achieve with new equipment it is very important to consider the distribution of log diameters. Wv all recognize that the lumber recovery factor increases with log diameter up to a certain point, but it is also important to recognize that the increase possible through the high recovery equipment is also considerably more for small diameter logs than for larger ones. One inch of sweep in a sixteen foot log is extremely detrimental on a five inch diameter, but it has very little impact on a twenty inch diameter log. On large logs the important factor is the large center cant and how it is broken down by the secondary breakdown equipment. Then we get into the theories of twin bands versus circular gangs.

It becomes quite interesting to bear in mind some of the things I have underlined when looking at new equipment. For example, there is the German system which is being offered in Canada.

Figure 17 is a cutting sequence for one of these processing lines. As this was explained to me, you first put the sweep in the vertical plane starting from the upper left hand cutting pattern and you chip two faces. The log is then rotated so the sweep is in the horizontal plane and two more faces are chipped. With the sweep still in this horizontal plane, two sideboards are chipped. In theory this becomes very difficult to do because the sideboards might need to be different widths and might require a different set of processing axis as I described earlier under three axis control. Anyway, the log is then rotated a second time so that the sweep would be back in a vertical plane again before chipping more sideboards and ripping the cant into lumber. If the cant were ripped like that when the sweep were in the vertical plane, you are going to end up with a lot of re-edging to do.

The positive aspect of this equipment is, of course, that you could eliminate the need for edgers along with the building space and operators. On the down side you could lose a lot of recovery with bad logs. The loss in sidecut recovery is of course not as important as the center cant where more of the volume is involved.

For these reasons, it is likely that the highest recovery will still continue to be achieved from operations which process the log in several stages with downstream adjustment for the cant and sidecut.

There is no question that end-dogging and side clamping systems consistently give higher lumber recoveries than we get with the present four sided Chip-N-Canters, but the high cost and low productivity may preclude their use for a little while. Because of the cost and productivity factors, many Interior mills will settle for intermediate solutions or upgrade present in-feeds for the present. When studying new rigs, careful review and the cost of benefits involved in upgrading the existing equipment should be carried out and the incremental benefits due to a new headrig then compared with that.

The increase in recovery possible will be less with those with sound, straight logs and more for those with sweepy logs. A very careful analysis has got to be carried out to determine the overall effect of the change on average mill net value and profit.

Process control systems still have to be regarded as very much under development and it is essential that mill people work with the suppliers in detail to be sure of the actual limitations of the system they are buying. Computer studies based on straight, round logs should be used with care.

For the foreseeable future, we will be relying on human judgment when evaluating cutting patterns and positioning logs and as the scanning and optimizing capabilities increase, the knowledge of the mill people must increase.

Looking down the road a bit, we may end up x-raying logs for defects one day. Because of the high cost, this will most likely occur first in mills which are trying to separate sharp and clear from common lumber. Also in the future significant changes to random width or random length lumber could close the gap and possibly affect the gap between present and potential recoveries. Finally, a growth in MSR lumber use could change the way we look at cutting patterns and force us into probability.

Throughout my discussion I have concentrated on many of the negative aspects of the high recovery picture. We are not going to solve all of these problems at once. We will be making incremental progress and selling systems which are not perfect. These intermediate solutions may, nevertheless, have very fast pay-back periods and provide us with the funds to buy the next generation of equipment.

Meanwhile, if we all learn as much as possible about the subject, we will be better equipped to select the intermediate solutions and will speed up the day when we approach perfection. I hope my comments will be helpful in that regard.

* * *

Table 1

Best of Two Sawing Systems* for All Combinations of Log Length, Diameter, and Taper.

Taper (in./16 ft.)	Diameter Class (in.)	Length (ft.)								
		8	10	12	14	16	18	20	22	24
1	6	-	F	-	-	F	F	F	F	F
	8	-	-		F	F	F	F	F	F
	10	-	F	F	F	F	F	F	F	F
	12	-	-	F	F	F	F	F	F	F
	14	-	F	F	F	F	F	F	F	F
	16	-	-	-	F	F	F	F	F	F
	18	-	F	F	S	S	F	F	F	F
2	6	-	S	-	F	S	F	S	S	S
	8	-	S	F	F	F	F	F	F	F
	10	-	F	F	F	F	F	F	F	F
	12	-	F	F	F	F	F	F	F	F
	14	-	F	F	F	F	F	F	F	F
	16	-	S	F	F	F	F	F	F	F
	18	-	F	S	F	F	F	F	F	F
3	6	-	S	-	S	S	S	S	S	S
	8	-	S	F	F	F	F	F	S	S
	10	-	F	F	F	F	F	F	F	
	12	-	F	F	F	F	F	F	F	S
	14	-	F	F	F	F	F	F	F	S
	16	-	F	F	F	F	F	F	F	S
	18	-	F	F	F	F	F	F	S	S
4	6	-	S	S	S	S	S	S	S	S
	8	-	F	F	F	F	S	S	S	S
	10	-	F	F	F	F	F	S	S	S
	12	-	F	F	F	F	F	S	S	S
	14	-	F	F	F	F	F	S	S	S
	16	-	F	F	F	F	S	S	S	S
	18	-	F	F	F	F	S	S	S	S
5	6	-	S	S	S	S	S	S	S	S
	8	-	F	F	F	S	S	S	S	S
	10	-	F	F	F	S	S	S	S	S
	12	-	F	F	F	S	S	S	S	S
	14	-	F	F	F	S	S	S	S	S
	16	-	F	F	F	S	S	S	S	S
	18	-	S	F	F	S	S	S	S	S

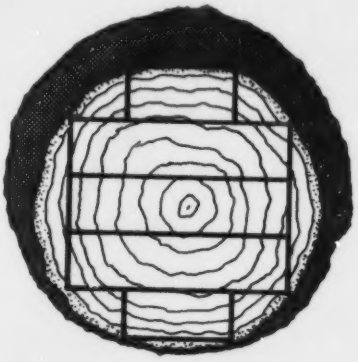
*Full-taper-full-taper-fixed fence (FTFTF) and split-taper-full-taper-fixed fence (STFTF).
F FTFTF is best
- no difference
S STFTF is best
Source: U.S.D.A., 1976. Is There a "Best" Sawing Method. Forest Products Lab., Madison, Wi.

Table 2

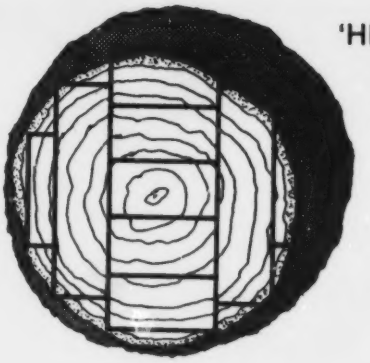
Yield (board feet and per cent of best total) For
Groups of Logs Sawn by Eight BOF Sawing Methods

Sawing Method	Original Study Logs		Log Distribution 1		Log Distribution 2		Log Distribution 3	
	Total (Bd. ft.)	% of Best Total	Total (Bd. ft.)	% of Best Total	Total (Bd. ft.)	% of Best Total	Total (Bd. ft.)	% of Best Total
Live								
ST[1]	734,592	95.52	20,025	95.56	6,219	93.80	14,364	94.44
FT[1]	742,295	96.53	29,369	96.73	6,345	95.70	14,619	96.12
Cant								
STST[3]	754,840	98.16	28,771	98.10	6,401	96.55	14,909	98.03
FTST[4]	761,620	99.04	29,104	99.24	6,509	98.17	15,118	99.40
STFTF[5]	758,193	98.59	28,868	98.43	6,439	97.12	14,928	98.15
FTFTF[6]	758,462	98.63	29,037	99.01	6,482	97.77	15,050	98.95
STFTV[7]	762,093	99.10	29,017	98.94	6,500	98.04	15,010	98.69
FTFTV[8]	762,29	499.13	29,169	99.45	6,525	98.42	15,132	99.49
Best								
Total[9]	769,013	-	29,327	-	6,630	-	15,209	-

[1]Split-taper.
[2]Full-taper.
[3]Split-taper on log, split-taper on cant.
[4]Full-taper on log, split-taper on cant.
[5]Split-taper on log, full-taper on cant, cant sawn against fixed fence.
[6]Full-taper on log, full-taper on cant, cant sawn against fixed fence.
[7]Split-taper on log, full-taper on cant, cant sawn against variable fence.
[8]Full-taper on log, full-taper on cant, cant sawn against variable fence.
[9]Total yield that would result if each log were sawn by the method giving highest yield for that log.



TYPICAL C-N-S



'HIGH' RECOVERY

EFFECT OF MORE PIECES?

FIGURE 1

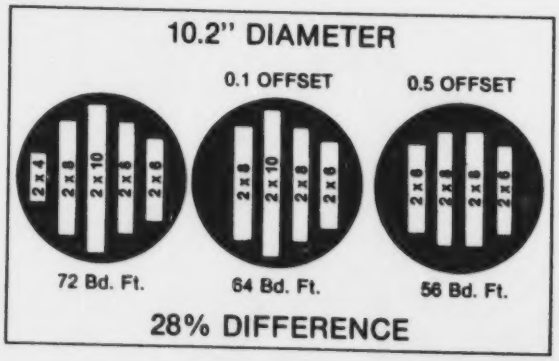
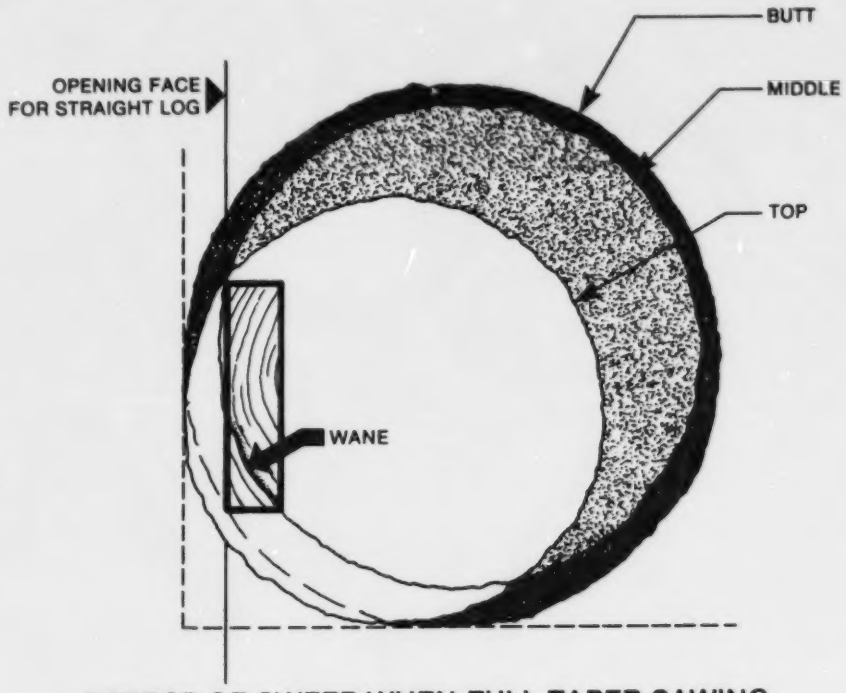


FIGURE 2



EFFECT OF SWEEP WHEN FULL TAPER SAWING

FIGURE 3

FIGURE 4

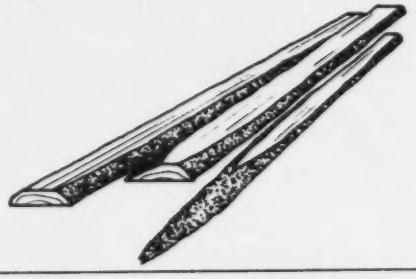


FIGURE 5

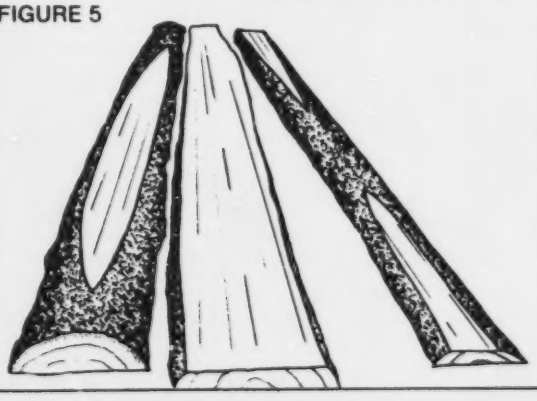
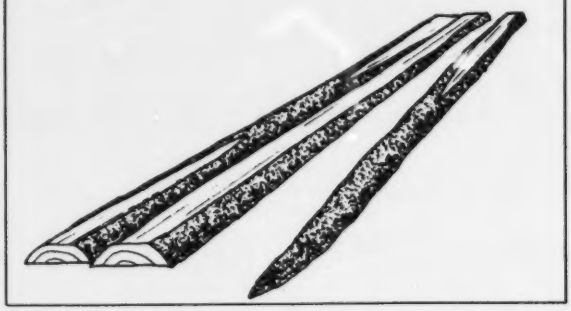
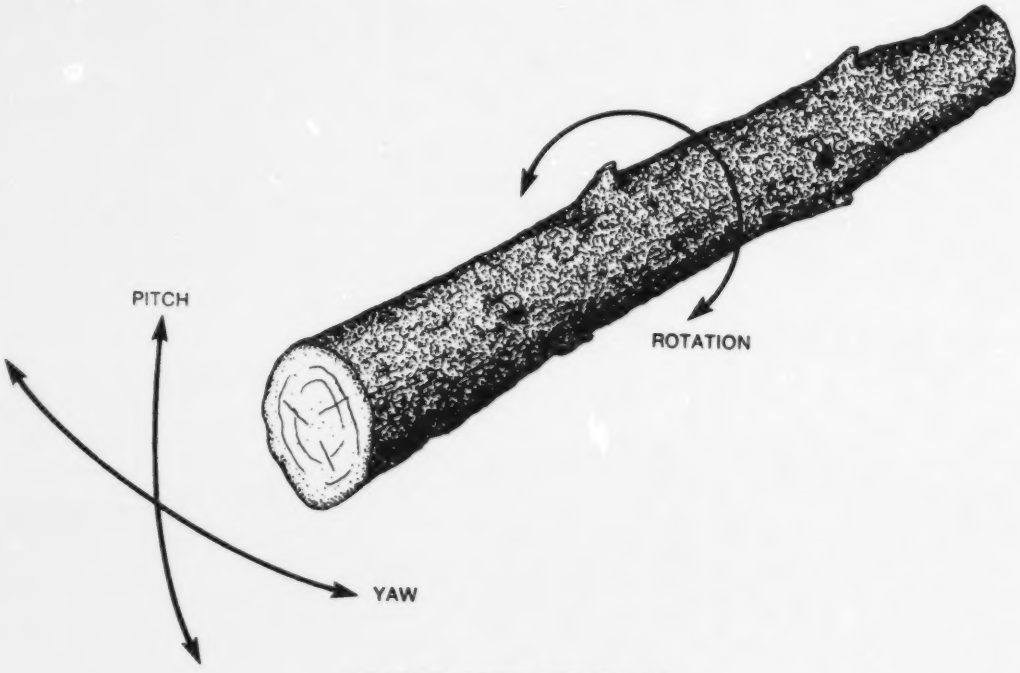


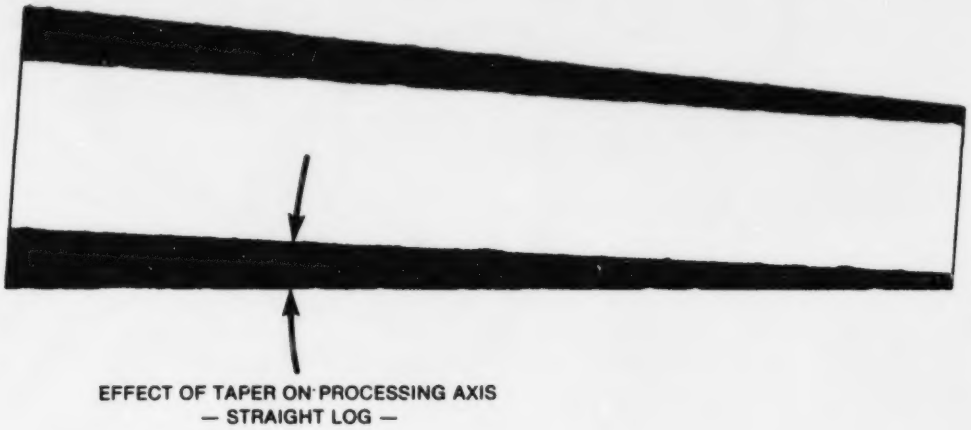
FIGURE 6





THREE AXIS CONTROL

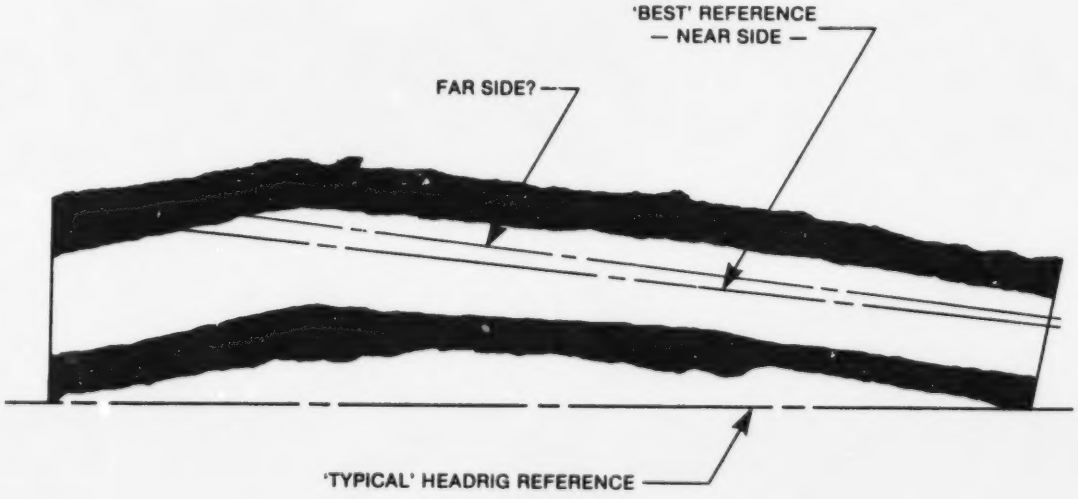
FIGURE 7



EFFECT OF TAPER ON PROCESSING AXIS
— STRAIGHT LOG —

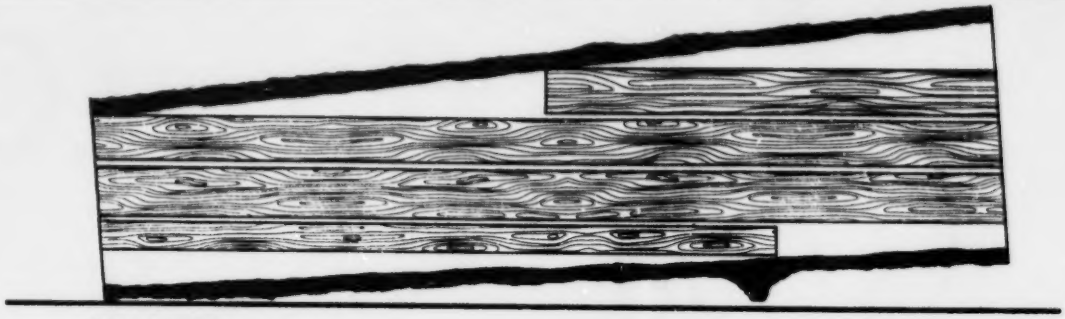
CANT OR SIDECUT

FIGURE 8



REFERENCE CONFLICTS

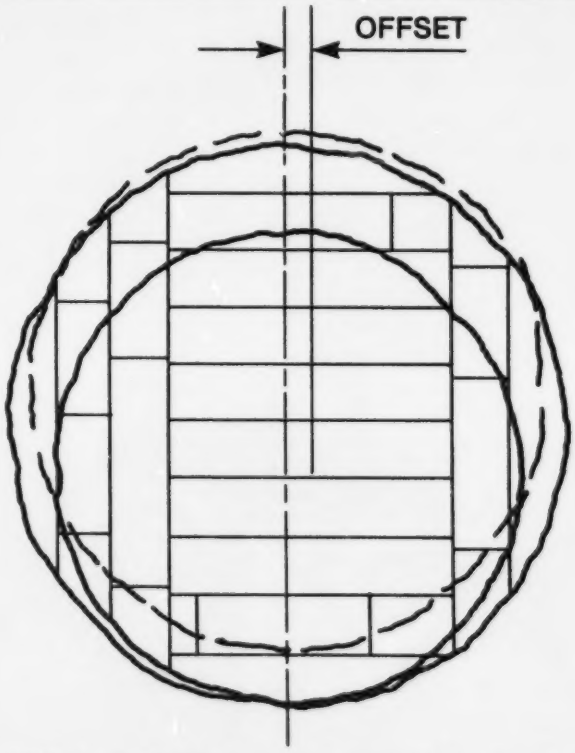
FIGURE 9



30.63 FBM

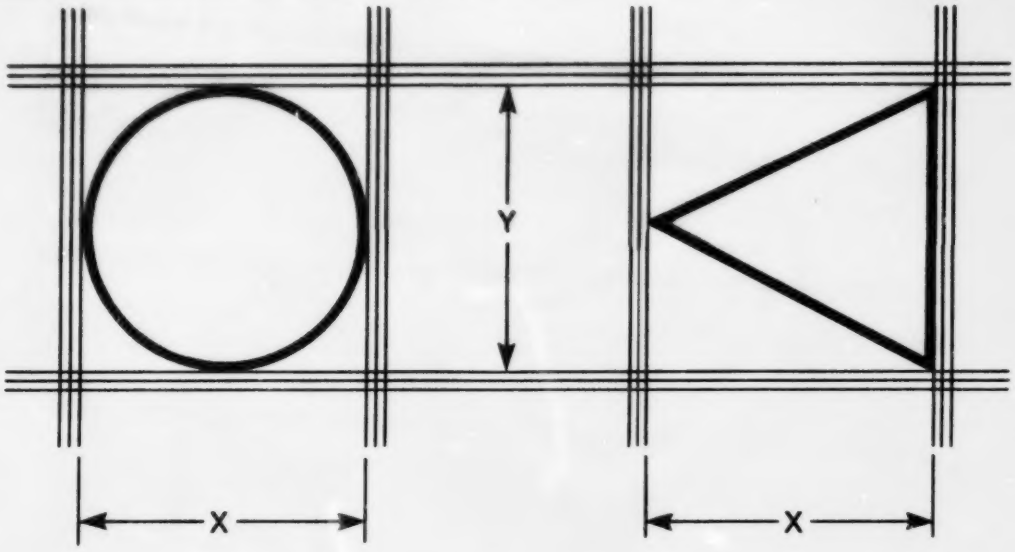
35.28 FBM = 15% GAIN & BETTER LENGTHS

FIGURE 10



'IDEAL' OFFSET VARIES DEPENDING ON AMOUNT OF SWEEP

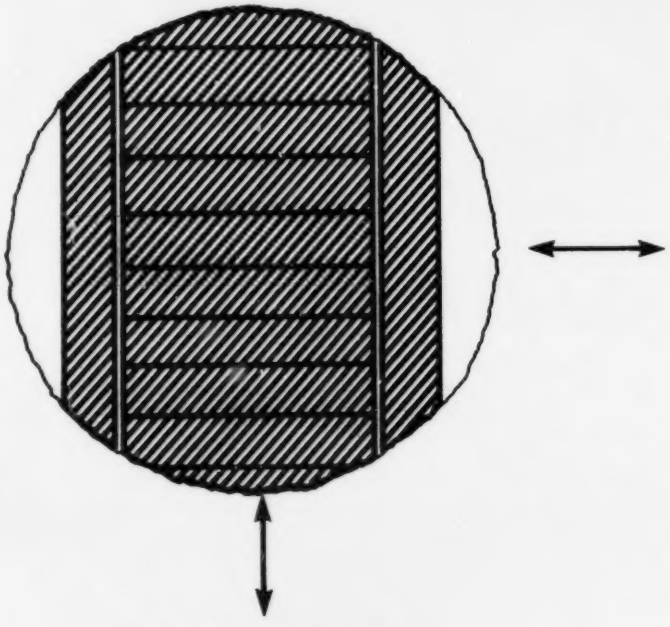
FIGURE 11



THE SCANNING PROBLEM-LOGS

FIGURE 12

FOR MAX. VALUE



HALF AND FULL TAPER
HORIZONTAL OFFSET
VARIABLE CANT POSITION
VARIABLE CANT THICKNESS

FIGURE 13

THE GEOMETRY PROBLEM
— DOUBLE TAPER SAWING

FIGURE 14

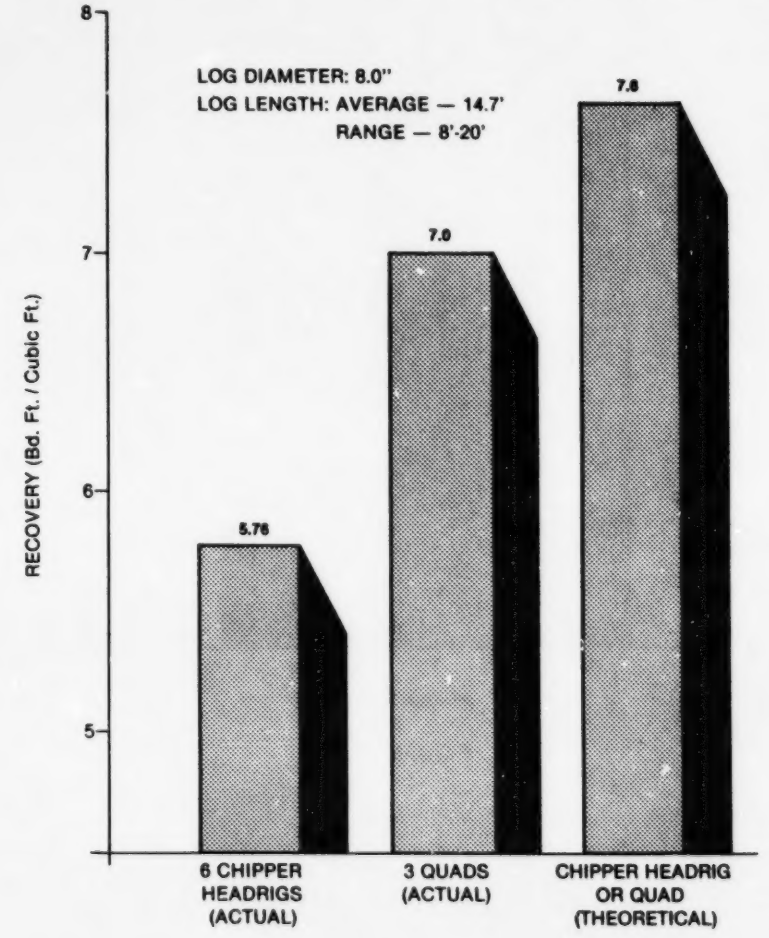


FIGURE 15

RECOVERY vs SWEEP FOR CHIPPER HEADRIG

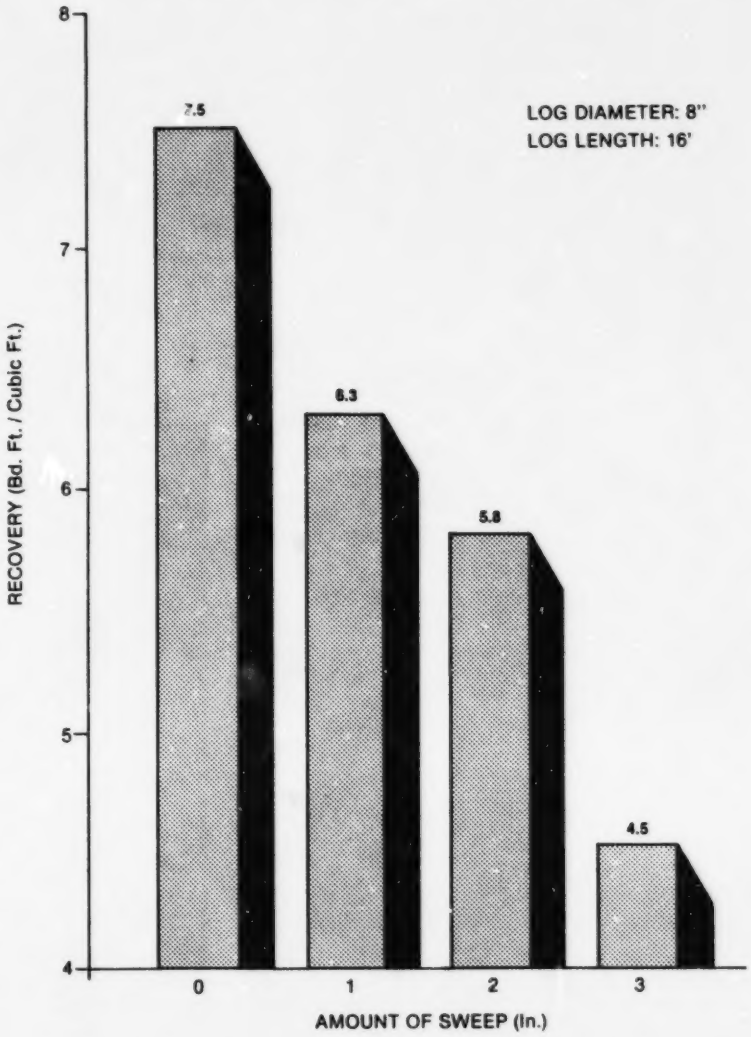
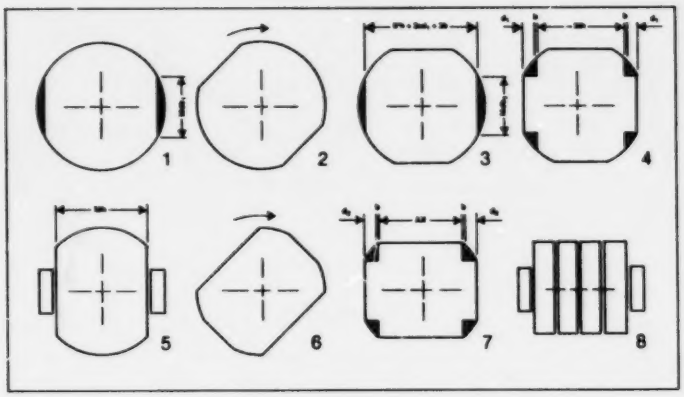


FIGURE 16

FLOW DIAGRAM FOR THE PROFILING TECHNIQUE



1 = Facing the first two wing boards under consideration of the minimum width.
2 = Turning the faced saw log by 90°.
3 = Putting on the next faces under consideration of cant height (MH), thickness of two wing boards (2 x d_2), two ripping kerfs (2 b) and the minimum width (Mdb_2) of the next two wing boards.
4 = Edging of the first two wing boards by the Profiling Unit.
5 = Cutting of the two first wing boards by the Sawing Unit.
6 = Turning the remaining cant by 90°.
7 = Edging the two remaining wing boards by the Profiling Unit.
8 = Cutting the remaining two wing boards and the four-faced cant into boards or deals.

FIGURE 17

Mill Experience with Edger Optimization

Fred Hamlin
Electronics Engineer, Weyerhaeuser Canada Ltd., Vavenby, B.C.

The edger optimizer that I plan to discuss is the Saab-Totem. It's not that much different from the other ones around. They all work under basically the same principle. And it's not new technology either. It started out in Sweden in the mid-60's I suppose. We first learned of it when one of our people, Eric Denton from Tacoma, went on a tour of Scandinavia and came across it over there. He liked the idea and he got together with a vendor in Seattle, Totem Equipment, and they came up with a manufacturing facility for it.

The first time I came across the edger optimizer was about 1968. That was the first one that Weyerhaeuser installed in North America and presumably the first anyone put anywhere in North America. Ours has been in place for two and a half years. It was number six for Weyerhaeuser and since then they have put in three more and there is one more being planned. So this is not new technology. We are dealing with not an old technology, but an aging technology. It has been around long enough to get the bugs out of it. So hopefully, you can look at it as basically a measuring and positioning tool that you can put on an edger in-feed. Maybe not in your existing situation, but it can be used to improve your recovery, and I'll try to just show you how.

Weyerhaeuser got into an extensive testing program on their edgers. Before they got into this too deeply, they put the one in Cottage Grove basically to see what would happen and they went around to the other mills to check their edging process to see what they could come up with. As it turned out, their edgers, in general, were running about 87 per cent of what the theoretical recovery was apiece. I will go through that edging test process and I would challenge you to do the same in your own mills at home. This is something you can do and there are some great rewards to be attained. There are some things that you can learn about your sawing practices that can be picked up from spending a little time with a simple piece of plastic.

What we would do is take a sheet of clear cylar plastic, and rule out the target sizes (widths). You would have your lumber grader, your mill foreman and your quality control people involved in this. You get down on the floor with twenty pieces (this is the number we use) and try to determine what we can make out of each board, knowing what we know about our wane rule. We determine how much we can get out of the board in recoverable lumber. We will record the expected result, and put the mark 1

number on each board. Then we'll fire them back into the mill flow and let them go through the edger. It is obvious that the edgerman is being tested.

What we found out was that under these conditions, where the edgerman is being a part of the process or at least understanding that there is a test going on, recovery is operating at about the 87 per cent level, which is pretty good. What we found was that when you get down to the floor and you've got four grown men arguing about these things, they can't decide right away what's happening. In fact you get some pretty obvious pieces on the floor and you find out you were dead wrong. It's amazing how much you will argue about it and you're expecting the edgerman to make a decision every four or five seconds all day long. It's incredible. You can't make up your mind in five minutes on this thing. He does a super job. One of the things this machine will do for you is it will help that man make that decision. He has a lot of decisions to make about that piece. One of the things the edger optimizer will do for you is skew that piece on the infeed, and give you a little more length and balance the wane on the sides of the piece

So our edgerman in the field was already getting 87 per cent on what he was doing and probably your

edgerman will do that too when you get back home and try this. And if he does, you can say you are recovering 87 per cent of your lumber, or you are throwing 13 per cent of your lumber to the chipper. Which way do you want to look at it?

Now it took time to build up to this, but over the last two years of that we are running well over 95 per cent recovery with our edger. In fact, over the last nine months we've been running 97.4 per cent well, over the last year, actually. We've picked up over 10 per cent. Our mill is running 132 million and we're running about one-quarter of the production through the edger. It translates out to about one-half a million dollars a year. That's based on a $150.00 price for rough green spruce.

Recovery in the mill is not only due to this edger optimizer but, hopefully, it was the catalyst behind a crusade to get our recovery up. Our overall recovery in the past two years has gone up eight per cent, which is incredible for an eleven year old mill which really didn't have any major changes not to the breakdown process other than this. But there was more attention paid to the details of what we were doing. One of things we were doing we came to understand that if we weren't putting wane on the lumber in our U.S. market, then we were throwing a lot of money away.

That's actually 11 per cent pick up on the recovery of that edger, but let's assume that it's 10 per cent. Then our mill is processing 20,000 pieces on a shift, 5,000 of them are processed through that edger. It has processed over 7,000 pieces on a shift and it's processed over 100,000 board feet on a shift. Our best day was 14,000 pieces through the edger in two eight hour shifts.

Our production this year (1983) will be 132 million. A quarter of that would be through that optimizer that would be 33 million feet. If we pick up 10 per cent, that's 3.3 million feet at $150.00 which is $495,000.00 and that's a lot of bucks. It cost us quite a bit of money to put that machine in because of where it was, but probably you could look at doing a similar type of thing for $1 million or a million and a half. I don't know what you people think about a two to three year pay-back but it looks real good to me.

* * *

Trimmer Optimization and Automatic Lumber Size Control

Al Sadler
Manager, Quesnel Operations,
Weldwood of Canada Ltd., Quesnel, B.C.
Ernie Buchacher
Division Engineer, Quesnel Operations,
Weldwood of Canada Ltd., Quesnel, B.C.

Al Sadler

The subject company of this paper, Babine Forest Products, whose major owner is Weldwood of Canada, is located 12 miles east of Burns Lake, B.C. They currently cut about 140,000,000 to 160,000,000 feet per year. It's a white wood dimension mill—four-, six-, eight- and 10-inch with some one-inch produced depending on lumber values.

The main machine lines or main machine centers that we have there are three Chip-N Saw lines, two Mark II's with in-line vertical edgers, double arbor, one Mark II with in-line 60-inch twin band mill and a 10-inch Schurman downstream under arbor. It also has two chipping edgers for re-edging the side cuts from the big machine, two QM 20-foot multi-saw trimmers and downstream from that are two 26-bin J-Bar sorters.

When we consider some of these capital projects, we have to do an evaluation of the various items that meet the demands of the "bean counters". Just to highlight some of these items, the first and main one we have to look at is the recovery potential, related to costing materials and security of long-term supply. This, on a long-term basis, is probably one of the more important things. We have a limited raw material resource, as everyone knows, and our forests are not going to last forever as we see them today, though hopefully through some intensive management we will be able to sustain what we have.

But certainly one of the easiest areas for us to improve is recovery. The second major area that we have to consider is productivity and I would imagine that to maintain our competitiveness in the forest industry, we continually have to search for avenues to upgrade our product base.

We have to look at productivity very carefully. It is one avenue that is available to us that we can expand upon and certainly offset the increasing costs of labor. The third main area that we have to examine is cost of labor and thus, labor saving. Associated with the cost of labor are things such as WCB costs, cost of training, turnover in isolated communities and other factors. The trimmer optimizer, as we saw it initially, met the demands of all three of these areas.

Ernie Buchacher

A general evaluation of lumber yield performance at Babine Forest Products indicated that existing recovery is equal or exceeds local industry averages; however, new developments in sawmilling technology appeared to offer a potential to improve recovery by as much as 20 per cent.

Figure 1 lists the major areas that can contribute to this improvement. These include computerized log bucking, minimized target sizes and saw kerfs, improved sawing accuracy, optimum breakdown solutions, improved breakdown efficiency and computerized edging and trimming decisions. In each of those areas, we did a general study to identify the potential pick-up associated with each one and the total opportunity that appeared evident there was 20 per cent.

Firstly, with the aid of the Forintek size control program, saw kerfs, target sizes and sawing variations were reduced. The effects of these improvements combined with the results of comparing log breakdown sawing solutions has resulted in an actual yield increase of approximately four per cent. The gratifying part of that figure was that prior to undertaking the program to make those improvements, that was basically what we projected the pick-up would be. The other point I might want to add is that this pick-up was achieved with a minimal basic investment, certainly well under $100,000. Probably the most important part of that pick-up was working with the operating people and they deserve a lot of credit in that regard.

The realization of the remaining opportunities listed required major capital investment and, in most cases, implementation disrupted existing production. In considering this, it is important that the methods used to calculate potential recovery increases provide accurate definitive results. I think our success on the sawing improvement and the size improvement did a lot to establish credibility when we went for the very large investment that was required to purchase the trimmer optimizers.

This paper will illustrate how data collected from mill tests of the sawmill trimmers was interpreted to determine present performance, predict improved potential and helped define and develop the optimizer specifications. Similar methods could be used to evaluate bucking, primary breakdown and edger performance. There were two main reasons why improving the efficiency of the sawmill trimmers was assigned a high priority. Firstly, trimming affects the total mill volume and, secondly, with proper planning trimmer optimizers can be installed with minimal disruption to existing production.

Testing of the two multi-saw trimmers was a joint venture undertaken by the AccuRay Corporation and Babine Forest Products. The programmable controller-based test unit interfaced to the trimmer control console was randomly used to select test boards and record the manual trim decisions. Outputs were issued to activate a spray marker and raise all saws when a test board was selected.

The 1,565 test boards taken randomly over a 10 shift period were sequentially numbered and set aside for grading. There was absolutely no control over the boards that were selected since this was done on the basis of a random number generator tied in with the test unit. These boards were examined by a Babine Forest Products lumber grader who recorded the overall length, base and the amount of trim as and where required. In addition, the reason for each trim requirement was recorded. The trimmer operator and lumber grader decisions were compared using an AccuRay computer program.

Figure 2 shows the result summary for the test. The test consisted of 1,565 boards on an average of 11.3 FBM. The sample had an optimum of 17,755 FBM. We actually recovered, based on the manual trim decisions, 16,526 FBM for 93 per cent of the optimum available volume, which resulted in an overtrim volume of 1,229 FBM or seven per cent. There was recorded undertrim volume of 1,893 board feet or 10.6 per cent.

Overtrim is defined as the volume of useable lumber lost as a result of trimming errors. Undertrim is the volume of wood not removed during sawmill trimming which must be removed at the planer mill to produce an acceptable product.

Figure 3 shows the board width distribution of the test sample. Fifty-five per cent, this is by piece count, 2 x 4; 34 per cent, 2 x 6; seven per cent, 2 x 8; two per cent, 2 x 10; and two per cent of the test boards had no useable lumber in them.

Figure 4 shows the board defect distribution. Referring to that figure there are two points to be noted. Approximately one-half of the boards are square at both ends and require a normal length trim only. The other significant point, if you discount the four per cent of the boards that have biological defects that cannot be detected using sensors, 92 per cent of the boards requiring trim decisions have edge and/or face wane defects. Considering this, it was imperative that the optimizer selected had sensors that accurately and consistently identified wane defects, preferably facing up or down.

Figure 5 shows the overtrim error frequency distribution. Referring to this figure, there are two points that are significant and should be noted. Firstly, almost 60 per cent or 58 per cent of the overtrim or trim loss volume was due to long length or slash errors. We found in the test sample that there were numerous sound boards 16 feet long and 2 x 6 that were slashed. I think we have enough faith in our people to say that they weren't intentional errors, but it is probably a matter of getting out of time when the trimmer decision was punched in. But it was a very large volume loss.

Another point to note that it takes a high frequency of two-foot trim errors to generate a measurable trim loss volume. I think if you spend a little time and study that and look at the error distribution it verifies the traditional belief that trim loss on a two or three saw trimmer would be substantially lower. You can actually go through that and approximate it normally on a two-saw or three-saw trimmer, your trim loss should be two or a maximum of three per cent, where we were running seven per cent.

The second point, namely the high frequency of two-foot trim errors to result in an appreciable volume, should be noted when evaluating optimizer recovery rates. Let's consider a potential or advertised recovery rate of 98 per cent and also assume that trim errors greater than two feet will be minimal. Based on our test board sample, to generate an overtrim volume of two per cent would require that a two-foot trim error be made on three out of every 10 boards requiring a trim decision or a resulting wane detection accuracy of 70 per cent. Improving this to 90 per cent, that is allowing one error per 10 decisions, would increase the recovery potential to 99.4 per cent. The point I try to make there is that when your trim loss is

running at seven or eight per cent, you get down to two per cent. It sounds pretty good, but maybe it warrants a little bit of thought to convert that back to trim errors.

Figure 6 shows how the use of a movable fence can increase trimmer recovery. Basically what we did there initially was just run the sample through a fixed fence and it shows there was a potential recovery of 99 per cent of the optimum available. The optimum being available with a shifting fence with one-inch increments. If you study this, there isn't any real pick-up on a fence shift increment less than three inches, but there are other considerations that are associated with accurate length resolution.

At one point, when considering the added potential of the shifting fence, it should be noted that the recovery increase attributable to the shifting fence feature is limited to that portion of the boards needing a lumberline trim.

Figure 7 illustrates two typical board descriptions where the movable fence does not offer any improvement opportunity. The first case, the board on the top of the figure, is one that is square at the lumberlined end, but requires a far-end trim due to wane defect. Regardless of how this board is positioned, there is no opportunity to increase the length. The second board has a near-end defect but because of where the good wood boundary lies on the far end, there isn't any way possible that you could shift that board that would increase its length beyond 12 feet.

While close-to-optimum recovery can be realized with three inch fence shift and length resolution increments, reducing this to one inch can offer additional advantages. To fully realize the potential of the shifting fence feature, length resolution is required to be equal to the fence shift increment.

Figure 8 shows accurate length resolution. The first case is a board that falls just short of the nominal length and bounced back on the bucking stops, where normally that top board would just miss the 16-foot sensor and be trimmed back to a 14-foot. Accurate length resolution with the trimmer optimizer would enable you to set that limit and whatever dimension was set just short of 16 feet would be allowed to pass, and you would pick it up as a 16 footer. The second example shown there is a board with bevel on the near-end, a good wood boundary of three inches and, again, a trim defect on the far end.

With a fixed fence system, to remove that three inches of defect you would have trim two feet off and drop the 14-foot saw. You'd then end up with a net length of 12 feet. With a fence shift feature, the fence would kick back three inches and you'd still be within the 14 feet. You either picked up two feet or ended up with the 14 foot length.

The final feature, when we were considering the trimmer optimizer, was thickness resolution of the sensing heads. As target sizes are reduced the need for a reliable size control program becomes increasingly important. It has been our experience that manual measurement is time-consuming and only allows a small per centage of boards to be checked. Consequently, extra thickness has to be allowed to minimize skip. Selecting a trimmer optimizer that provides accurate thickness resolution will allow every board produced to be checked for thickness. This should allow a further reduction in target size and eliminate the labor associated with size control.

Al Sadler

At this point we'll examine the mill flow at Babine. After the primary breakdown section, there are three lines basically merging into two (Figure 9).

One of the major considerations that had to be dealt with at Babine was the existing mechanical configurations. We basically didn't change the location of most of the areas, but we did have to make some changes to the section between the eliminators and the multi-saw trimmers. The net effect of that is to basically reduce one man. Among the items that had to be changed were the main chainways between the eliminators and the new unscambler, which were lowered to provide a little more depth. The jump belts from the edger out-feeds gave us basically one main option. We could transfer one line over to the number two trim line, but with the optimizer installation we decided to provide the flexibility to dump into either line.

Short bar unscramblers were added to layer the lumber for presentation to the scanners. New unslug loaders were added to singulate the lumber for scanning. Scanners were added to measure thickness, width and length. Positioners have been fabricated and at least one of them is installed. These positioners are basically of an air cylinder configuration and operate from one inch through 23 inches. We could have gone to a linear positioner, but that was considered a little bit in the order of 'overkill'.

PC's, or programmable controllers, were added to control the trimmers as we know them today and as they will be operating in the future. Currently, they are operating in a manual mode and they will eventually be commanded by the computers themselves. All these mechanical modifications have, or will have, been made, which allows for debugging separate to the actual optimizer computer installations as well as allowing for exposure to the mill floor relative to technological changes.

One of the areas we can't overlook is exposure to the mill floor, and it's not just our front line supervisors who are involved. It is becoming increasingly important to expose individual workers to technological change, and through doing that the acceptance of change will be a lot better and it will make it a lot easier when conversion takes place.

The flow diagram shows that the net labor saving is one man per line, which translates into four men per shift rather than two persons per shift or two persons net.

Non-contact thickness sensors are installed and these are in resolutions of 5/1000th's on two foot centers. Those are in the Phase One section which uses Trienco scanners identical to those used at the Lakeland and Lignum mills. The Phase Two section will probably not be operational until February 1984. This will fill in the two foot centers on a one inch increment and will give us thickness resolutions in the order of 20/1000th's. They are fibre optic scanners, similar to the laser scanners in terms of the way they operate.

Profile sensing accuracy on a width basis is .83 inches. On length we are looking at about 1/10th of an inch, and hopefully, the scanners will be as accurate as promised. In addition, we have a size control program, something we recognized as being needed very early in the game after we put the Forintek size control program into effect. There is no doubt that a size control program is extremely valuable in lumber recovery. The volume of information generated can really only be handled properly with a computer. The thickness scanners, with the resolution that they provide, will give you enough accuracy to digest all this information and produce reports relative to size control.

Another area we recognized that we needed was board positioning. A linear positioner would do the job but was somewhat of an overkill, as previously mentioned. So we wound up with a wide fence which will position in one inch increments through 23 inches. Another specification we required was that positioning and trimming functions took place at up to 60 lugs per minute. We are running in the order of about 54 lugs per minute. And we would presume that afterwards it would go down to 52, but we provided for flexibility.

Phase One section will use Trienco laser scanners, 11 on the top and 11 on the bottom for each line, to provide differential thickness measurements on two foot intervals. Phase Two involves Trienco SIS-2 fibre optic scanners which will complement the laser scanners and fill in scanning on a continuous basis. Scanning will be provided on a 'top only' basis. Experience with these units will indicate if they will operate in both 'up' and 'down' positions. All the information that is generated from these scanners will be computed by two Computer Automation units, one for each line. The software was supplied by Byte Controls.

One of the more important areas that we had to take look at was payback (Figure 10). We have highlighted several areas as being potential paybacks in this project.

The overtrim and undertrim reduction, for the sake of making things easy in the calculations, we have put at 40 per cent. We have labor savings and the total savings. Other factors were not considered for the actual payback. As can be seen from the diagram showing overtrim and undertrim, we've put annual production at 140,000,000 and we've taken a reduction in the overtrim, less the trim loss, which has given a unit, a net increase of 720,000 board feet. In annual savings, that 720,000 times the $200 per thousand, less chip value, less the cost of packaging the chips had you made that material into lumber. This would yield you almost 1.2 million dollars per year.

Reductions in labor involve probably four men per year at $33,000 each year, or another $132,000 per year. We take the total savings and come up with $1.3 million. So we are looking at $1.3 million savings per year which are big dollars.

Even in tough times the payback that is generated by a trimmer optimizer is substantial. It is anywhere from $850,000 upwards.

Non-quantified items in the payback that we didn't cover in the calculations included improved reject decisions or re-edging and the size control program. Wane parameter flexibilities like thickness were also a benefit. For example, if you want to be heavy to wane on your two inch and almost square on your one inch you can build that into your computer. You can't build it into the trimmer operator who is just standing there.

Increased management reporting functions are another plus. I think that in today's sawmill, we can't overemphasize the need for management reporting. Everybody wants a report and not too many people ever sit down and really take a good look at how long or how much time your front line supervisors or your mill superintendents are spending on that report. The computer can give it to you in relatively simple terms. If you leave your supervisor to try and look after it or a management individual, you'd have people problems. Benefits also include length development programs. We are always being told by the sales people that we should be trying to maximize certain lengths. As a general philosophy, we at Babine believe that on the green end in the sawmill we should go for

recovery and leave the length development to the planer. That type of philosophy probably won't get you into too much trouble, but should you run into an anomaly in the market, such as the unexpected demand over the past couple of years for 2 x 6 12-foot lumber, then at least you can load that in and see what develops, but you should try and make it on the green end.

More savings can be achieved with a reduction in planer feeder rejects due to severe undercut. One of the problems is that we get snipes or spears and, once that reaches the planer, we have difficulty trying to feed them. Invariably they get thrown out or rejected altogether and a good piece of lumber is lost. It is an area that we never really quantified. It exists and we know that we will save in the future.

Consistent trimming is another advantage. I don't know how many times you've gone in on a Monday and seen the guys that are still hung over from the weekend, but it plays an extremely important role in our operations today. It's not just the trimmers that suffer from such problems, but certainly the trimmers are dealing with a 100 per cent of your output so this is a vital area.

The ability to monitor overtrim and undertrim is yet another benefit. When we take a look at overtrim and undertrim, it has to be tuned to the mill and also to the operations. You may decide that for some reason, because you have more planer time than you want by your undertrim, to cut your overtrim down to almost nothing. Or the converse may be true of that.

Elimination of the key operator is also worth considering, particularly since this involves a high noise workstation. I guess as we are directed more and more by the WCB we almost have to make sound-proof environments. In our new mill flow we won't have a trimmer operator as we know him today. He'll be somewhat remote and probably in a position that you can shield him with an accoustical booth.

In summary, some of the factors we have to consider are the ever-changing role of electronics as we see it today in the sawmill. To be scared by electronics is probably something that we should get out of the way as soon as possible and put behind us because we see too many examples throughout the sawmill industry where managers or even the mill operators are apprehensive. Also, and this can't be overemphasized, is the impact on your operations people, your mill floor. If you expose these people to electronics they're going to accept it and they are going to accept the technological changes that are brought about by electronics.

* * *

Figure 1

Potential Sources of Recovery Improvement

- Computerized Log Bucking
- Minimized Target Sizes and Saw Kerfs
- Improved Sawing Accuracy
- Optimum Breakdown Solutions
- Improved Breakdown Efficiency
- Computerized Edging Decisions
- Computerized Trimming Decisions

Total Potential Recovery Improvement 20 Per Cent

Figure 2

Results Summery for Sawmill Trimmer Test

Number of Test Boards	1,565
Average Volume/Board	11.3 FBM
Optimum Volume	17,755 FBM
Recovered Volume	16,526 FBM
Per Cent Recovered	93 per cent
Overtrim Volume	1,229 FBM
Overtrim Per Cent	7 per cent
Undertrim Volume	1,893
Undertrim Per Cent	10.6 per cent

Figure 3

Board Width Distribution

Board Description	Number of Boards	Per Cent of Boards
2 x 4	857	55
2 x 6	529	34
2 x 8	113	7
2 x 10	33	2
Slash	33	2
Total	1,565	100

Figure 4

Board Defect Distribution

Board Description	Number of Boards	Per Cent of Boards
Square Both Ends	712	46
Square L.L. End Wane Far End	469	30
Wane L.L. End Square Far End	112	7
Wane Both Ends	140	9
Defect Other Than Wane	63	4
Biological Defect	69	4
Total	1,565	100

Figure 5

Error Frequency Distribution — Overtrim

Trim Error	No. of Errors	% of Errors		FBM	% of FBM	
0-2 feet	221	64		349	28	
0-4 feet	36	10	77	123	10	42
0-6 feet	9	3		52	4	
8-20 feet	26	8		189	16	
			23			58
8-20 feet slash	52	15		516	42	
Total	344	100		1,229	100	

Figure 6

Effect of Moveable Fence on Trimmer Recovery

0 — 24 Fence Shift

	1 Inch Inc.	3 Inch Inc.	6 Inch Inc.	12 Inch Inc.	Fixed Fence
Volume	17,755	17,632	17,691	17,678	17,593
Per Cent of Optimum	100	99.9	99.6	99.5	99

NO IMPROVEMENT DUE TO MOVEABLE FENCE

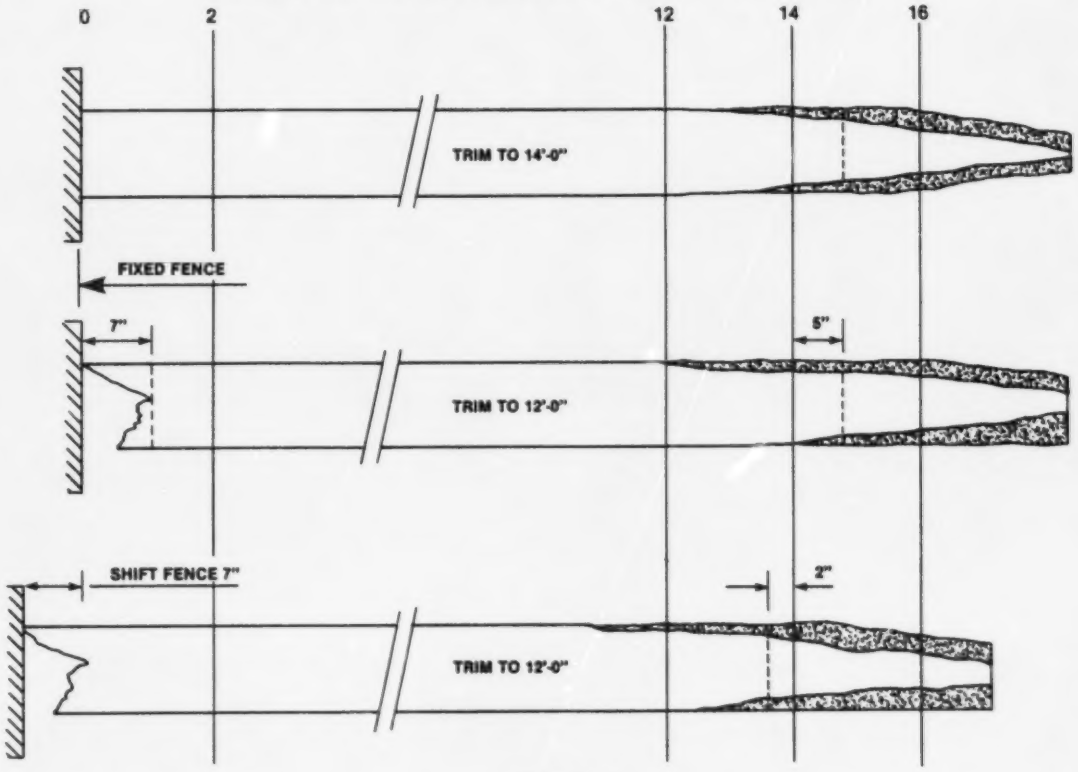


FIGURE 7

IMPROVEMENTS DUE TO MOVEABLE FENCE

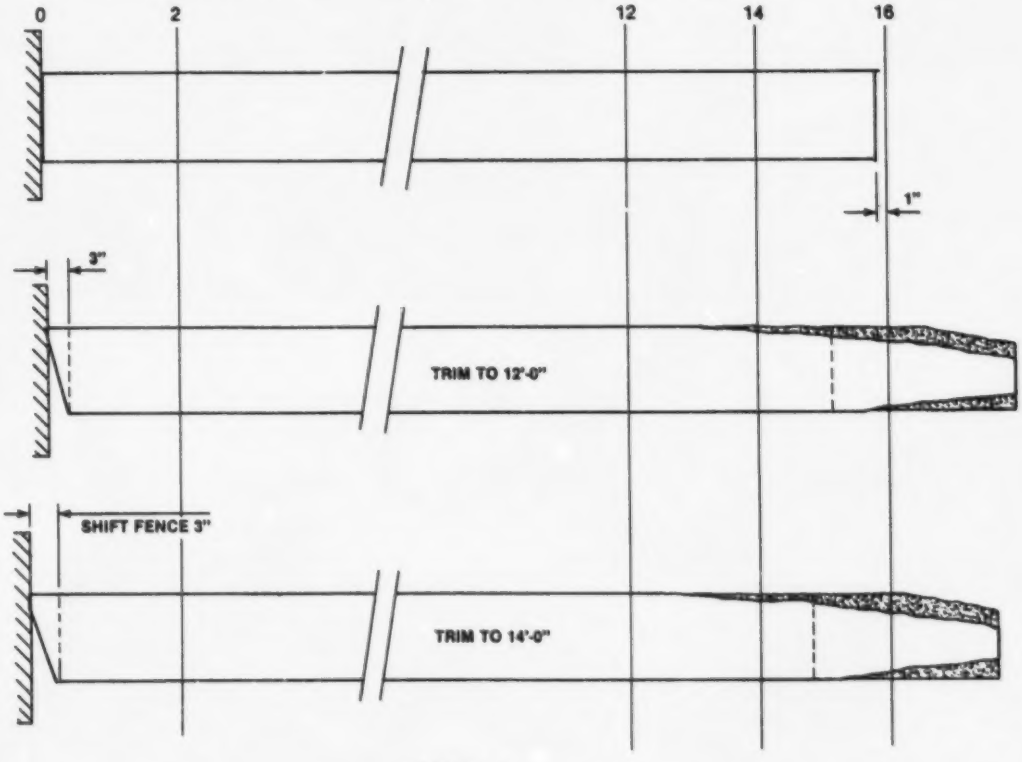
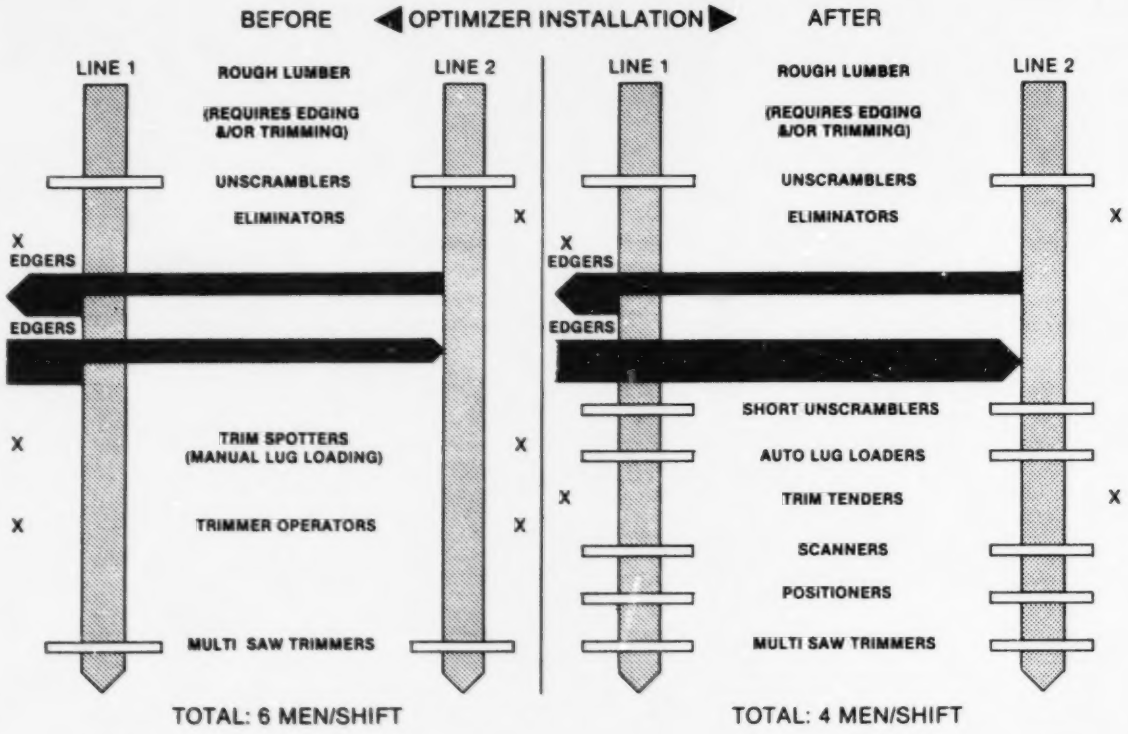


FIGURE 8

MILL PRODUCTION FLOW



TOTAL: 6 MEN/SHIFT

TOTAL: 4 MEN/SHIFT

(X = OPERATOR LOCATIONS)

TOTAL ANNUAL SAVING:

2 MEN/SHIFT x 2 SHIFTS/DAY x ANNUAL WAGE + OVERHEAD

= 2 x 2 x $33,000/YEAR = $132,000/YEAR

FIGURE 9

TRIMMER OPTIMIZER ANNUAL PAYBACK

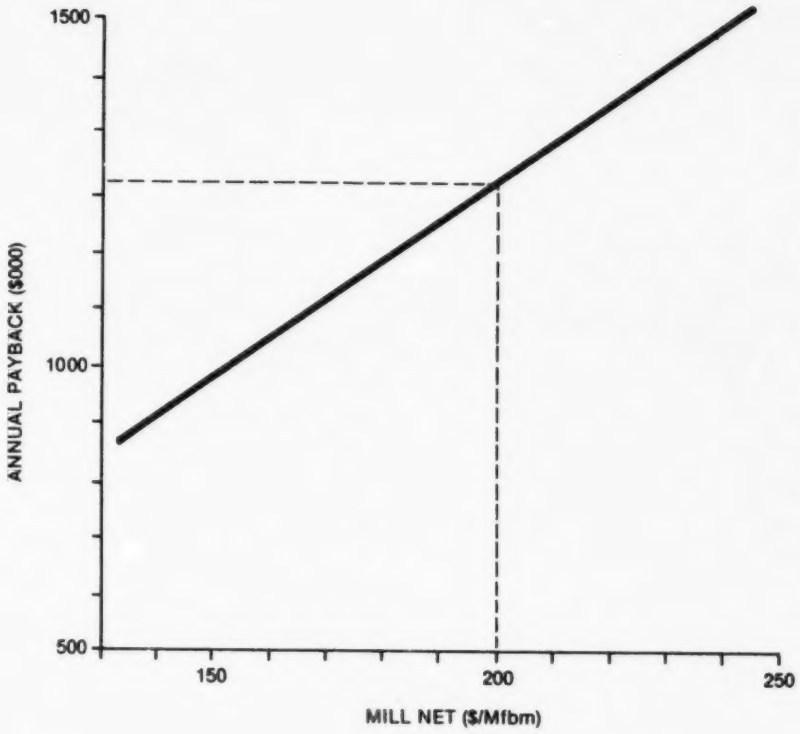


FIGURE 10

Computerized Kiln Controls

Graham MacKay
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The subtitle of my presentation as shown is Advances in Kiln Control and Advanced Measurement Systems. In fact, most of what I have to say relates to the first of those, namely advances in kiln control. Basically I want to review where we are today or where we were until very recently in this area, and in so doing perhaps identify some of the areas where we are deficient and where we can use some different technologies.

Let's assume that in your mill you have a new kiln operator, and you provide him with a reference text dealing with kiln drying. Very quickly he will come to a section that will deal with schedules. The schedule tells him what conditions of dry bulb and wet bulb to use for a particular species and for a particular size of lumber and for how long to leave that lumber in the kiln. It makes no reference to the condition of the wood, by which I mean specifically, the moisture content of the wood. It makes no reference to the size or shape of the kiln or to the shape or size of the load in relation to the kiln. Likewise, it makes no reference to the air flow or sticker size. It tells him only temperature and times. And until very recently he would typically operate the kiln using a vapor filled, pneumatically activated controller. This type of controller is very slow to respond in that while you may appear to have very good control of the kiln by virtue of straight line on the recorder chart, a more sensitive measuring instrument would indicate temperatures were up to 15 degrees on either side of that line.

Rigid time-based schedules are adequate provided that the lumber going into the kiln is essentially the same charge after charge. However, particularly with respect to the SPF group, we find varying proportions of the three species. Additionally, we have mixtures of sapwood and heartwood with varying levels of moisture content and ease of drying. We have mixtures of green lumber with air-dried lumber, and now mixtures of green lumber with bug-killed and fire-killed lumber. These are good reasons not to use a very rigid time based schedule. We therefore need a drying system that takes account of the state of the wood in the kiln, and it must be sensitive to the properties of the wood. Several attempts have been made to do this. The majority of them are computer assisted or controlled and these are what are now described.

Of the eight examples, some are widely used, while of others there may be only one or two examples. Gann, Hildebrand, Lignomat, and Bollmann are German, Utec is Swedish, the Potlatch and Union Camp Companies in the U.S. have developed their own systems, and, finally, there is the B.C. product, the Frank Controller. The German systems are essentially similar, using the same basic principles. Basically, they use an extension of what you recognize as a resistance-type moisture meter. Probes are inserted in a selected number of boards in the kiln and an attempt is made to measure the moisture content of that wood by a moisture meter in the kiln control room. That data is input that can be used in a computer assisted system.

One other pair of sensors is used to measure the EMC or the moisture content of a wafer of wood, or a wafer of cellulose which reacts very rapidly to changes in the kiln and gives a very good measure of the EMC.

The computer or microprocessor is set to run to a prescribed schedule, which instead of being given in terms of dry bulb temperature and wet bulb temperaturess actually works on the basis of the ratio between the measured EMC of the wafer of wood and the measured average moisture content of those boards in the kiln that have the electrodes in them.

There are some limitations to this system, however. One is that a resistance type moisture meter is accurate only at the fibre saturation point (25 to 30 per

cent MC) or less. Close control of the kiln is therefore only obtainable in the latter stages of drying when the wood is down to about 25 per cent or less. Secondly, the very presence of electrodes in the boards can itself be a problem due to an additional contact resistance set up in the wood. Thirdly, care is required in the selection of boards from a charge that will be representative of the total charge.

The Swedish Utec system, of which we are now seeing one or two in B.C., is a rather interesting one. First, the kiln operator answers a set of questions posed to him by the computer with regard to the state of the wood going into the kiln. The computer asks, for example, for the species, the size, the volume of wood in the kiln, whether it has had any air drying, whether there is to be a conditioning period at the end of the schedule, and what the final moisture content is to be. After getting all that information, the meter selects one of a number of pre-programmed schedules which it thinks best suits that wood and the way it is to be dried. During drying it measures the air temperatures on both sides of the load and the humidity throughout the kiln, and by application of a number of mathematical equations, it carefully controls the operation of the kiln to follow the schedule that has been set.

The Union Camp Co. system was developed at one of its mills which was faced with a problem of warp due to overdrying of lumber. It was recognized that in order to control the degree of warp in the loads, far tighter control of the kiln was necessary. The kiln they developed is capable of controlling the temperatures in 12 different zones along the length of the kiln and up the height of the kiln. Based on a supposition that if they could control the rate of drying throughout all 12 zones to be the same, then moisture content of all the lumber at the end of drying would be the same. Moisture content is inferred by assuming that the rate of drying is related to the temperature drop across the kiln. That is, by measuring the dry bulb temperature on one side of the load at one point and then the exact opposite side, the temperature difference was an indication of how fast the wood in that zone was drying. Thus this kiln, via a computer, is controlled for drying at essentially similar rates throughout the total load.

While on the subject of kiln uniformity, I would like to describe a service to industry provided by Forintek that we call kiln evaluations. We send a team of people to mills that request this service and we very thoroughly instrument the kiln to measure air flow on both sides of the load, along the whole length and up the side of the loads at over a hundred locations. Throughout the whole drying period dry bulb temperatures are measured on both sides of the load at regular intervals along the length of the kiln. We examine accuracy of kiln control instruments, and we measure the moisture content of dried lumber selected from locations where problems were found to exist. Our report to the mill includes recommendations for any changes or repairs that are required.

Two examples of problem areas are described to show that no matter how good a computer based system may be, if the kiln itself is not in good shape there is little chance of success in drying. First, one kiln had air flows from 60 feet per minute to 850 feet per minute. This we found to be not uncommon, particularly in line shaft kilns. So, clearly some upgrading was required. In another kiln where we were measuring dry bulb temperatures, there was a 50 degree spread end to end. So, again, any control system that was operating, perhaps by measuring the temperatures just at one spot along the length of the kiln, would have little chance of success.

The Frank Controller, to be described by another speaker, also measures the temperatures across the load. In addition, it computes the relative humidity and the EMC in the load.

* * *

Computerized Kiln Controls

Don Yorston
President, QM Industries Ltd., Prince George, B.C.

QM Industries has a research and development division called Frank Controls Limited which is involved in the manufacture of kiln controls. QM started out in the dry kiln field putting thermal oil into numerous dry kilns and looking at proposals for generating more such business.

One of the things that we noticed working in the field with different kilns was the fact that users all seemed to have different views on operation, scheduling and temperature levels, none of which were very consistent. We found that there was a tremendous variance in the quality of lumber and the amount of time it took to dry. This led us to believe that as part of our approach to drying lumber with thermal oil we should look at the kiln control.

At that time we had an associate, a consultant, who had an idea which involved drying lumber using relative humidity. It was his idea that if you put lumber in the kiln and turned on the heat you were going to get some moisture coming out of that lumber. By measuring that moisture across the load, it should be possible to determine what's happening with the wood and to subsequently develop some type of effective control system.

Based on some of these original ideas, we built a computer control. Basically, it was a Z-80 computer and we assembled all the hardware. At this point we had to find somebody that would be interested in allowing their kiln to be used for tests. Drying lumber is something that can result in costly errors if you don't know what you are doing. The kiln that we originally worked in was quite old, one of the older kilns in Prince George, but in very good shape. It was located at the Rustad operation.

On looking at what we've done since, we were very fortunate that we started at this operation because their lumber piling was good and the kiln was in good condition. If we had started at some of the places we worked at since, we would have quit before we got there! After we worked for some time, we installed the control in August of 1982, and worked for about four months. We weren't really doing anything that was really substantially better and in a lot of cases we were possibly a lot worse than the system used up to that date.

Dry kilns right now are run by fairly simple instruments. Basically they look at heat temperatures plus or minus five degrees and makes some control decisions over fairly long periods of time. Sometimes it's not really clear just what benefit a computer will bring. Once we saw that the original idea really didn't do what we thought it would do, we were in the dark and stumbling a bit.

In about October of 1982 we started getting some very good results at Rustad's on that one kiln. One of the biggest factors we noticed was that by running the kiln in one direction, reversing once, using a fairly high humidity and controlling the venting we found that we reduced the amount of gas a little bit, though not by very much. But the one thing we did notice was that the wood started to look of better quality than the wood being dried before. It looked more like air dried wood. So after we'd done quite a bit of work and tried a few charges, they did some tests in the planer mill and determined that the wood was of better quality and ordered four more kiln controls. That kiln only had 6 million BTU and was a fairly large unit. I think they put 250,000 board feet into the kiln.

It didn't really tell us everything we wanted to know about what other conditions we could get, so we went to West Fraser, Quesnel, and we put a control in there.

The four at Rustad were shipped at the same time as the one that went to West Fraser. West Fraser had a kiln of about the same capacity as Rustad's—about 250,000 board feet—and it had about 15 million BTU and was a vintage Cruickshank unit, a block kiln with fair air circulation and good heat distribution. There again, we were lucky that the piling was quite good, the baffles were efficient and things subsequently worked out very well. We got some very spectacular results at West Fraser, based on reducing the time they were in the charge by 25 to 30 per cent. They did some trim tests in the mill and these showed that they had a reduction in trim loss of about five per cent

based on comparing 'our' lumber with some other lumber that they ran in the kiln using their conventional control.

Another point noticed was that their Number Two and better increased by about three or four per cent and they had actually put in meters to measure gas. After the first charge, the management said, "to hell with the gas". Obviously, where this system will pay for itself is in lumber quality. Based on running this unit for quite a while, they bought 22 dry kiln controls.

At this stage of the game, and even today, we are still in a 'prototype' situation. We have really only been at it for two years at this point and I think in a week we sold something like 40 controls. We put in a number of kiln controls in a variety of places and we found out that it wasn't really magic. They didn't really work everywhere for there are a lot of problems involved in drying lumber.

At this point we'll examine just how the kiln control works. We heat up the kiln under a controlled humidity and control the humidity as the kiln comes up to temperature. We look at the relative humidity on one side of the kiln and the relative humidity on the other side and the temperature difference. We're working on the idea that if we can get a flow of the free water out of the lumber without doing any case hardening we will actually be able to remove that lumber without putting any stresses on it and without using any extra energy.

Our kiln control measures in tenths of a degree and makes control decisions every second and a half or two seconds, as opposed to a standard control which would measure plus or minus five degrees and would make a decision every two or three minutes. With conventional controls you get a nice, smooth temperature curve, but in actual fact the heat is really going up and down. It's just the pneumatics in that control that make it look level.

So that computer would very accurately measure the temperature and humidity difference. What we would do is continue to give the load heat until such time as we noticed that we were getting less moisture on the other side. When we could see that we were starting to get less moisture, we would then back off on the heat.

The drying pressure that you're getting in the kiln is really a function of the heat, the relative humidity and the velocity of the air. If you keep increasing the temperature in the kiln and you are trying to evaporate the water away from the face of the board at the same rate that it's transfusing to the outside, you've got the water coming out of the board and you've got dry air coming to take it away. If those two rates are similar then you'll get efficient drying and you won't case-harden the wood. What will happen is that if you increase that heat a little bit more, all of a sudden you'll start taking away more moisture from the face of the board than is actually developing and you will start to case-harden.

When you case-harden the board it becomes too dry and that dryness has the effect of preventing more moisture coming to the outside, making drying more difficult.

In actual fact, the process is a lot more complex than that, but in reality that is more or less the principle of what we're doing. We're really looking at that humidity and temperature very carefully and making control decisions based on what is happening across that board in terms of temperature drop and relative humidity.

We then run the kiln in one direction. We don't have any idea when we put that lumber in there exactly how long it is going to take to dry. We don't make any measurements of the initial moisture or ask any questions or indicate what species is involved. We just put the lumber in and turn on the kiln.

As the kiln comes up to temperature and starts to run, the computer looks at the data that's coming back out of that kiln and that is where we get what we call the 'closed loop'. That is why we are using the computer.

At this point there is quite a lot of data, the computer is looking at that information and it more or less decides what to do from that. The schedule that you get is completely a function of what you put in the kiln. If you put bud-killed wood in it might come out in 17 hours or if you put in very wet wood it might come out in 38 hours. It depends on how much heat you've got.

The kiln control will work regardless of whether you've got high heat or low heat because if it calls for heat and there is no heat there, well then it just won't dry as fast as it could. If you have more heat, the control would dry faster, but if the heat's not there it can't use it. Really what happens at that point is that we run that kiln until the data tells us it is time to make our one reversal. When we reach that point we reverse. If it came out in 32 hours, we'd run, say, 26 hours one way and six hours the other. Once the kiln control is balanced for the kiln and we have the parameters set, the lumber will come out dry. The kiln will shut down and it will be balanced from side to side.

One of the problems is that there is a lot of information about exactly what happens in the kiln that we are still discovering. In some cases we've gone into people's kilns and put in one of these controls, thrown the switch and walked away and the lumber

comes out fine. The times are good and the energy is down and everybody is happy and it's just great!

We've been working since June on a kiln at Burns Lake. We are now at the point where we can say that we understand what's happening there and we are starting to dry lumber. It is a very complicated process, and a Frank kiln control is still really a prototype. It is still something that is being developed. One of the factors that is really important is that the kiln operators have to be involved with what we're doing and why we're doing it.

Briefly, some of the snags we've found that have really held us up in drying lumber include a variety of possible conditions. These include: air leaks between kilns where you've got kilns that are all tight together, and the air is leaking from one to another, and you can't see it because it is going into the kiln next door; poor velocity around wet bulbs; no chimney in the lumber; kiln leaks; vents that don't close; kilns that either don't have baffles or the baffles don't work; kilns that have missing fans or fans that are wired in backwards; and kilns that don't have water in the wet bulbs.

Right now we have about 24 of these kiln controls in and working and we've got another 10 or 12 that we are in the process of installing. We've still got five or six controls that are in kilns that don't work. At this stage of the game, we have really whittled it down. We now know when we put a kiln control in whether it's going to work when we start it up or not. If we can get rid of a lot of the problems in the kiln ahead of time, then we know it's going to work.

Some of these problems can be dealt with in the control. For instance, leaks in the kiln aren't completely fatal. The control can allow for that. It just makes it tougher to put the unit in and make it work if you have a kiln with a lot of leaks. Some of the things we are starting to get into as well include putting multiple bulbs in the kilns.

Instead of just measuring in one place across the loads, this computer is fairly powerful and we can measure in as many as eight zones down the kiln. At this time we are only doing two because we seem to get a fairly good balance in most kilns with just one and I think two is going to pretty well pick up the ones we are having trouble with on a balance from end to end.

I think the biggest advantage of the Frank kiln control is the fact that once you've got it in there and you've got it working, it is really easy to operate and is very consistent. It takes the operator error out of drying lumber. That is a very important point because training dry kiln people doesn't seem to be a high priority. There seem to be a lot of untrained dry kiln people out there, though we have found them to be extremely cooperative to work with while not being very knowledgeable. Essentially, from charge to charge, you put the lumber in and you push the green button that says 'start' and when the lumber is dry the red light goes on and it is time to take the lumber out.

Shorter schedules are another benefit. Depending on what the mills are doing at the present time, we've had schedules anywhere from 10 to 40 per cent quicker. And there again, because of the extreme variance in the industry with regard to performance, in some cases 10 per cent or five per cent is all that we're gaining. In other places, it's as much as 40 per cent.

Better lumber quality is a definite gain. This is something that discourages us a little because when we put these controls in, a lot of people just want to look at how much quicker we get the lumber out. From my point of view, the real pay-back is that you get better lumber out of that kiln. If you are looking at three or four or five per cent less trim loss due to a better dry kiln, then that's really where the big pay-back is.

A shorter schedule, although it gets more production through your dry kiln, shouldn't be the complete measurement on whether the unit is a success. We would like to see more of our customers doing tests for lumber quality.

In some cases we have had very good gains on energy savings—from five to 25 per cent. Another plus when we get the control working is better grouping. We find that balsam is coming out still wet but it's closer. It is pretty hard to dry balsam in a mixture of spruce pine and try to take the spruce pine to 15 per cent and put that four or five per cent balsam in there and hope it is going to come out dry as well. Our experience has been that we still get wet balsam unless we overdry the other material.

In pretty well every case we are getting closer to dry than we were. We don't have any probes or sophisticated processes associated with this control. It is a reasonably easy unit to service from a standpoint of maintenance and you more or less change a card if the card fails. It is reasonably self-diagnostic and we don't find that people have too much trouble with it from a service point of view.

* * *

Computerized Integrated Manufacturing

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Today, we have to accomplish a change in the way we operate, a change greater than the Industrial Revolution. International competition, high social expectations, all kinds of reasons, but they all mean productivity improvement for peoples, nations, sawmills—productivity improvement or join the unemployed!

That is a very real threat. We sell our products in an unforgiving market. Not only do we compete with each other, but more importantly with the Swedes, Finns, Americans and, not far behind, the developing nations. No benevolent government of our own devising can protect us from their competition.

And then we have that other competition for our work and resources. The society which we serve demands environmental protection, recreational and agricultural land use, higher taxes and payment to the unemployed.

Productivity is the result of many improvements. Productivity means not only production speed, recovery from raw material, maximum utilization of machinery, reduction of absenteeism, or the motivation of the worker. It also means getting the highest value from our products. Productivity means continually updating our production machinery and improving our forests. Productivity means larger and larger capital investments and the need to attract investors. Productivity is the sum total of many things which simply boil down to getting the most abundant benefits for all concerned.

But how is the computer going to tie all of this together?

First, remember that the objective is maximum productivity in the fullest sense of the word. Second, consider where we are in microelectronics today. In only ten years, interrupted by two recessions—one them drastic—we have come a long way to applying computers to our machines. From experience we know that they are highly reliable and do indeed provide enormous gains in productivity. Now, they are steadily sequencing machines, counting lumber, scanning logs, computing sales values, setting saws—all consistently better than ever done by human hand and brain. Now the operator is well on the way to becoming a supervisor of a machine center, and the manager can start to feel that some of the decisions by some of his operators are coming under his control.

But consider what the manager really has to encompass.

The manager has to use his mind to knit together log supply, machines, people and markets to make a profit. And he has to get effective action and reaction or information flow. Those who accuse sawmilling of being 10 or 20 years behind the rest of industry do not begin to appreciate the incredibly intricate and fine detail which that simple equation represents for the sawmill manager. The many decisions being made in seconds by each operator, the priorities and problems of the maintenance worker, the changes in market value, the most profitable use of varying log supplies, personnel training and absenteeism. These factors make management in our industry the most difficult of any I know.

Define it as you will: the Third Wave, the Information Revolution or the Computer Society. Today we are in the churning upheaval of The New Revolution. During the past industrial revolution the prime strategic resources were capital and labor. But in our new society it is knowledge. In our information society, value is increased by knowledge.

We are now beginning to see the shape of this new revolution. Figure 1 summarizes the employment trends during the onset of the information revolution. The proportions of the total labor force involved in

productive and non-productive activities are shown. One the left, the situation in Canada with the United States on the right. In 1959 in the United States and in 1963 in Canada, transition points were reached when there were less people in productive activities than in non-productive.

That rather steeply declining lower line in Figure 1 represents the production workers involved in our respective primary industries. There is a lot more in these trends than we have time to outline, but more rapidly declining production trends in Canadian primary and secondary industry compared to the U.S. were the portent of our present economic troubles. During the 1970's the transfer of workers from production even accelerated, and we failed to compensate by increasing productivity. In other words, Canada lived beyond the income generated by her productive economy and failed to build her economy. This situation was well summarized by the president of the Investment Dealers of Canada recently when he said, "The principal reason for the depth and duration and misery of our recent recession and our continuing fundamental problems in Canada is our appalling decline in productivity. Productivity improvement in Canada has declined for the past eight years. Canada now has the poorest productivity performance of any industrial nation.

"We have a high level of unemployment because our ability to produce and sell goods in Canadian and world markets has been gravely impaired. In 1970, Canada's share of the world trade was in the order of five per cent; it is now in the order of three per cent. This represents billions of dollars of lost export sales and the loss of millions of man hours of work."

The point I want to make here is that my opening threat, increased productivity or join the unemployed, is not an empty cliche.

The corresponding trends of white collar and blue collar workers is shown in Figure 2. Blue collar is declining while white collar is increasing. Primary production workers are decreasing and, note this, service workers are almost constant. We used to think that the post-industrial society meant more service workers. Not so; it means more knowledge workers.

So microelectronics is far more than process control, it is knowledge processing, and knowledge is wealth.

Here are a few more facts about the value of knowledge:

- In 1950, only 17 per cent of us worked in information jobs, now more than 60 per cent do. (Programmers, teachers, clerks, managers, designers, accountants, lawyers, bankers, technicians.)
- Now only 13 per cent of our labor force is engaged in manufacturing.
- Again, at the turn of the century, farmers were one-third of the labor force; today they are only three per cent. In fact, today there are more people employed full-time in our universities than in agriculture.
- Of the almost 20 million new jobs created in the United States in the 1970's, only five per cent were in manufacturing, while almost 90 per cent were in information or service jobs. Conclusion: North Americans today are essentially information workers.
- And all the time our gross national product, in real terms, has been increasing. Conclusion: Knowledge is indeed wealth, and most especially, if it is at our fingertips for the task in hand.

In the 1950's, Soviet Premier Kruschev stood in awe of the fields of Iowa corn. Today his successors must be in awe of our mightily increasing knowledge and the wonderful and cheap little tool which is the key to the application of all this wealth. The social and economic revolution foaming around us stems from that little box. To some it is a monstrous menace; to others a gentle genie.

I want to show that the monster really is in truth the gentle genie who will tie machine and mind together for the average wood products manager and his staff.

I say eventually. We are only beginning. But I also intend to show how man's mind and machine are already being integrated by computer in our industry. A computer is not silicon chips and integrated electronic exotica. It is an expansion of man's mind, which will eventually enable him to comprehend the wholeness of his environment, which affects him or his task at hand. For the mill manager and his staff, the computer must be user-friendly, interactive and self-teaching.

I don't want to over-simplify, but I do want to stress that the manager should not be encumbered by bauds, kilo-bytes and so on. This is the vocabulary of the people who have to furnish his total computer system. They may talk in Pascal or Fortran, but the manager talks in sawmill or plywood. He has to ensure that the programmers and others produce programs which accurately and comprehensively represent his whole operating environment. To do this, he has to truly think and act as a manager of his whole operation.

Computers must be user-friendly so that foremen, shippers and maintenance clerks are as comfortable at a terminal as their children are at TV games. They must be interactive so that the information the

computer asks for is immediately processed and a response right there. They must be self-teaching so that all the knowledge the user needs to know is there, should he need it.

The computer is not a tool for doing paper work. It is, in fact, a tool for mental work. It should liberate the manager and his staff from routine and detail, make time and mental capacity free to seek new initiatives, plan, innovate. The computer, as an extension of the mind of the manager, will liberate, so that the information flowing in and the evaluation performed can enable him to make the decisions he needs, and monitor and control for the highest productivity attainable. The manager will no longer have to be a bit of a specialist on everything he can master, but once again, a generalist who has a better grasp of his changing environment, and who can change with it.

I have described our challenge and the role of the computer in making the incredibly intricate network of information to be analyzed and controlled amenable to management. Now some examples, not of the future, but of today. All this is with us now and available to bring about the next wave of sawmill development. Here is a selection of the many programs being provided or prepared for the wood manufacturing industry today. There are certainly others of which I am unaware. I am going to briefly review some of them to illustrate how they integrate machine and management.

Dynamic Control Systems

Figure 3 is an example of a total machine and management control system. This machine control system consists of any number of different machine control elements working separately to provide setworks, feed speed and other separate process control functions all linked together by a central management information computer system. Because it employs separate micro-processors, the system has the potential to permit the introduction of various adjustments to decision logic at the individual operators' consoles and yet still operate as an integrated interactive whole.

This overall system, called Dynamic Optimization by the supplier, is shown as having a more complete management information monitoring and control system imposed. This is what they call their Mill-Net system. Consider the dynamic optimization system as the manager's hand, the Mill-Net system as his brain.

This management system (Figure 4) would most likely have its own information processing computer, modular in concept so that individual aspects can be separately added or adjusted. The various elements could be interfaced with control and data collection modules throughout the mill and the system could monitor and control management input and output data including diagnostic and quality control data.

The management computer in this example is not directly controlling the machines. It is a single-source management control because it is the direct link between machine and management, out-putting information programmed for management's particular needs in the form of graphs, tables, reports and warnings, transmitting to the individual machine centers revised instructions for specific machines and operators.

Needless to say, well-designed systems would not be churning out masses of data and paper, a common failure of earlier efforts. Now we present only the esswntial facts required by the enquirer. The shift operating supervisor receives what he needs to know, or the maintenance foreman, or sawfiler, or production manager; each scanning and/or controlling his own, each free to assess, think and act in total relationship to the whole process.

Although not shown here, other important links—and this can all be built up progressively—would be to include: quality control - scanners monitoring sizes at any machine center ensuring immediate recognition and correction of mismanufacture; market information - sales orders, values, inventory status, sales orders, log purchases, controlled and integrated with production.

Monitor Systems

Figure 5 shows another system designed to monitor and analyze production. Each machine center can have an operator's monitor and the individual monitors are interconnected to a central computer with various terminals as required. The machine center monitor receives information from sensors identifying specific facts such as feed speeds, piece counts and delays. Superimposed on these are operator inputs. For example, a delay of more than a predetermined amount causes a signal to the operator to input a downtime cause. Communications to and from the operator are incorporated.

The central computer enables the supervisor to oversee the status of all his machine centers and attend to problems. He can call up more detailed information, he can redirect flow and machine loading.

Analysis is a key feature of this system. For example, trends resulting from certain cutting breakdowns may, by analysis, indicate that certain circumstances—specific log sizes, for example—result in production slowdowns at some related key machine center. Therefore, a different manufacturing

strategy may be called for, or a machinery change justified.

Figure 6 illustrates an analysis performed for someone who needed to know the relationship of cants to pieces at the trimmer.

A very important aspect of the specific custom capability of these systems is the management reports. Custom designed and, as shown in Figure 7, again avoiding masses of output so that the different management staff each get to see what they need to know for their particular needs, tailored for their own plant. A different report and different information is available for the maintenance department, production superintendent, quality control supervisor, manager and others.

Production Simulation

There are a number of programs available which can simulate or model for the sawmill manager or designer the various production aspects of his process. Some relate to the sawing process only. Some are largely comprehensive models of his own plant. Quite accurate and easy to use models can be constructed which operate much the same as his own operation. With these programs, it is possible for him to blend in with his existing log mix, for exampie, a new log purchase he may be contemplating, then flow it through his mill.

The headrig in such a computer model would cut at speeds depending on the depth of cut for his own log sizes, generating various pieces for the different machine centers. The program would be summarizing yields in dimensions and grades, calculating revenues based on different market values, identifying production limitations. All this done without the manager leaving his desk so that he is free to think and conceive.

Sawmill Production Simulation

These next examples are from a user-friendly interactive and self-teaching program. Note that the user has only to respond to simply stated requests and replies with a simple stroke, he doesn't have to be a typist and there is no computer jargon. The instructions are always screened, but he can quickly flash by when he is familiar.

Programs like this give the user easy but comprehensive ways to survey his plant and his options. For example, if he is seeking information on how his plant would respond to a particular production simulation, then by pressing "A" he can look at his log supply, and by pressing "H" he can see the condition of his machine center. Not difficult, just type "H" and he immediately receives a scan of his key machine centers to see how they are coping with his simulation. He sees it in a flash. If, for example, the scan indicates that he has a problem with he board edger, then he types "10" and immediately sees the key production data and how that machine is affected.

At any time, he can easily rerun the whole model, changing all the variables at his command, running extra shifts, using alternative breakdown strategy, trying other log mixes, until he has determined the optimum production plan.

Incidentally, if he wants to examine a machine, he not only can see how it is affected by a particular production loading, but he can review its vital characteristics, feed speeds, saw sizes and other factors. An example of having specialized knowledge at his fingertips.

Quality Control

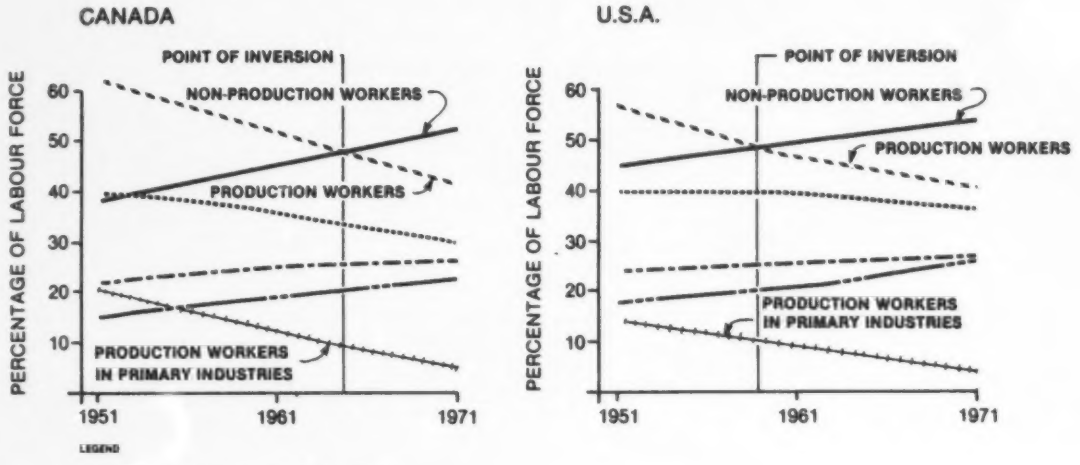
Quality control programs are starting to bring under increasing management comprehension all the vital quality control aspects. Especially noteworthy is the extremely practical lumber size control program pioneered and made available to the sawmill industry by Forintek and COFI. This program conducts a sawmill through an accurate evaluation of their sawing accuracy and establishes realistic target sizes for their own particular machinery and maintenance standards.

It monitors their progress and keeps them on track. It has the potential to relate inaccuracies to specific maintenance routines, tying in with saw-filing, preventative maintenance. Of all productivity improvement opportunities which I have analyzed, this has consistently shown the highest cost/benefit potential.

I hope that I have been able to give a view of not only the opportunity we can look forward to in the future, but those that are available now to bring about productivity improvement and bring all the benefits in increased productivity to industry, workers, and society.

* * *

INDUSTRIAL EMPLOYMENT



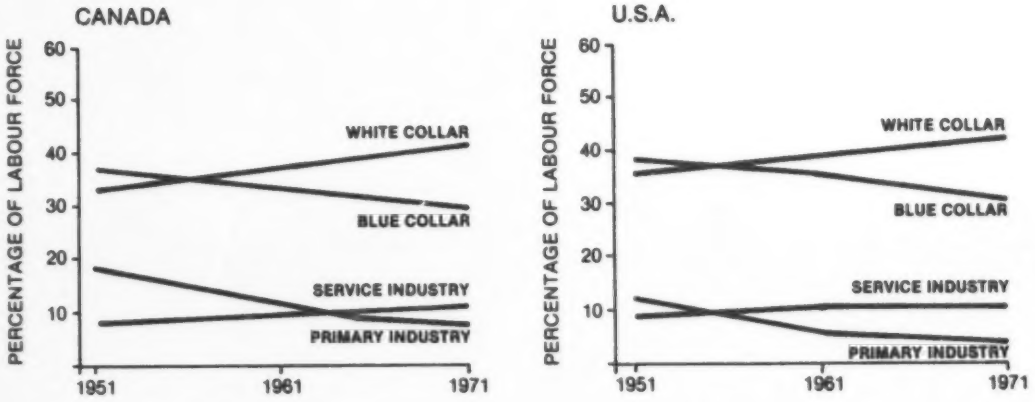
LEGEND

(1) Total of (3) and (5) — Immediate Production Sector
(2) Total of (4) and (5) — Non-Production Sector
(3) Secondary Industry (Manufacturing, Electricity, Gas and Water, Construction, and Transportation).
(4) Trade, Finance, Public Administration, and Defence.
(5) Services (includes Community, Recreation, Business, and Personal Services)
(6) Primary Industry (includes Agriculture, Fishing, Forestry, and Mining).

SOURCES: Statistics Canada, 1971 Census of Canada, Vol. III, Part 3. Cat. No. 94-758, Supply and Services Canada, Ottawa, Table 7: United States, Bureau of the Census.
CENSUS OF POPULATION: 1970 Detailed Characteristics, Final Report, United States Summary. U.S. Government Printing Office, Washington, D.C., 1973, Table 77 and 236. Worton, David S., "The Service Industries in Canada", Production and Productivity in the Service Industries, in V.R. Fuchs (ed.), National Bureau of Economic Research and Columbia University Press, 1969, pp. 237-ff.

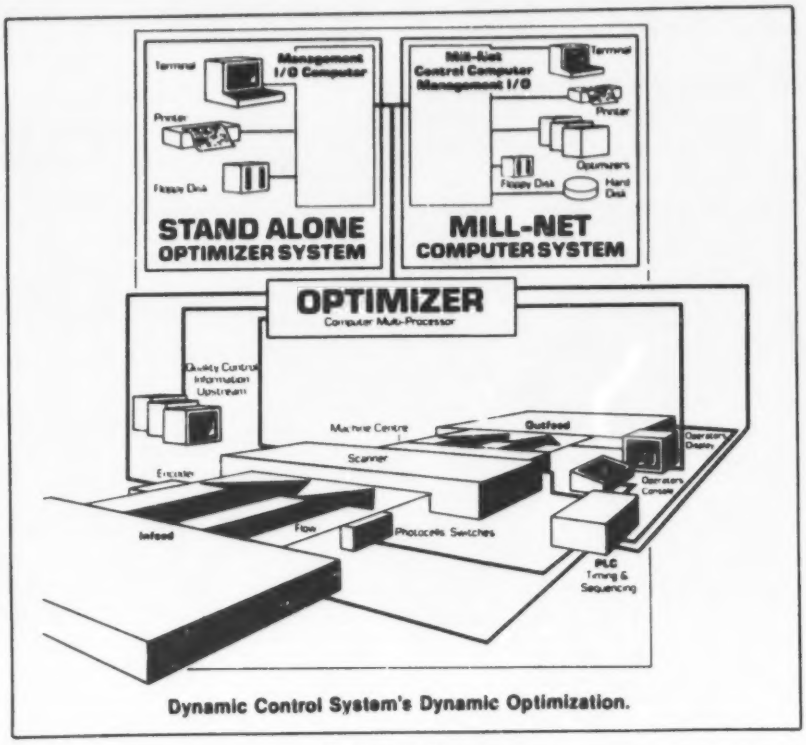
FIGURE 1

LONG TERM TRENDS IN ECONOMICALLY ACTIVE POPULATION



SOURCES: United Nations, Demographic Yearbook, UN Department of Economic and Social Affairs, New York, selected years.
International Labour Office, Year Book of Labour Statistics, ILO, Geneva, selected years.

FIGURE 2



Dynamic Control System's Dynamic Optimization.

Figure 3.

DYNAMIC CONTROL SYSTEMS

MILL-NET

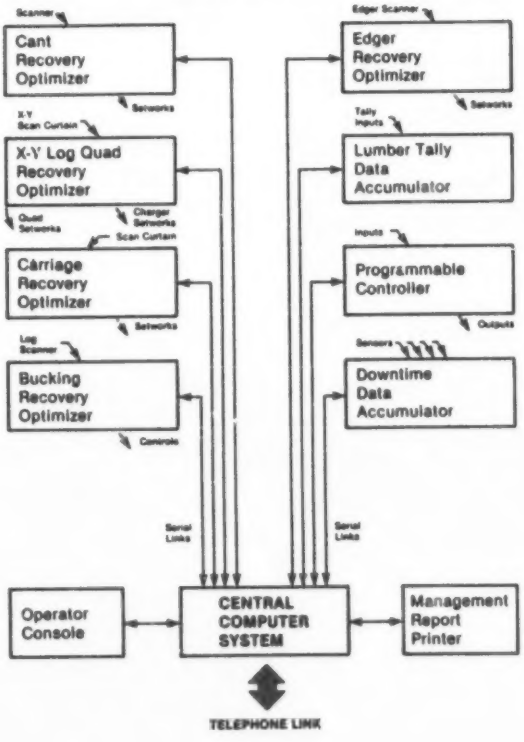
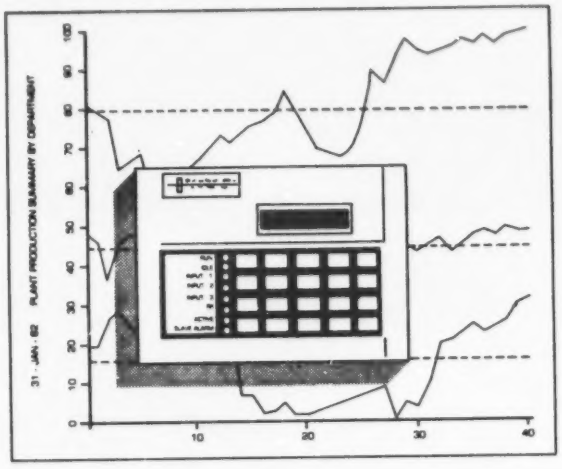


FIGURE 4

PRODUCTION ANALYZER™



- INCREASE PRODUCTION
- ANALYZE FLOW PATTERNS
- REDUCE MAINTENANCE COSTS
- JUSTIFY CAPITAL IMPROVEMENTS

FIGURE 5

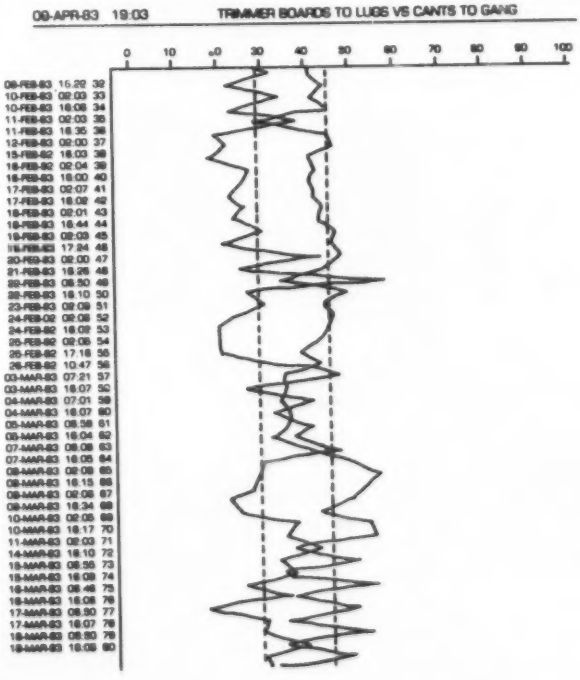
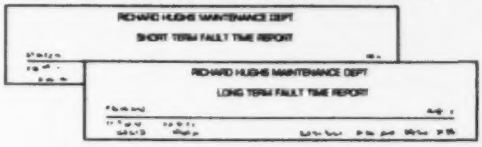


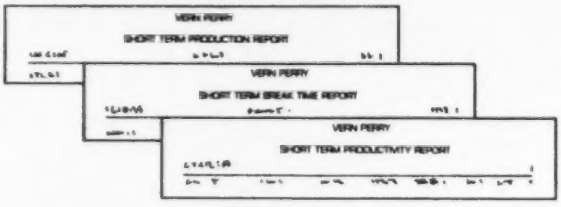
FIGURE 6

YOU TAILOR TO YOUR NEEDS

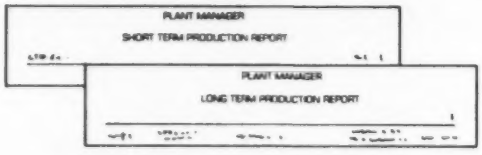
FOR THE MAINTENANCE DEPARTMENT


RICHARD HUGHS MAINTENANCE DEPT
SHORT TERM FAULT TIME REPORT
RICHARD HUGHS MAINTENANCE DEPT
LONG TERM FAULT TIME REPORT

FOR THE PLANT SUPERINTENDANT



FOR THE PLANT MANAGER



FOR THE INSPECTION DEPARTMENT

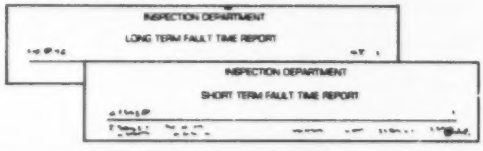


FIGURE 7

Closing Remarks

Craig Walden
Director, Forintek Canada Corp., Vancouver, B.C.

What I am going to say about the program summary is going to be rather brief. I think that one of the points that stuck out in my mind today as we listened to the speakers was Dennis Oldknow's comment about how relatively unique it is when it comes to selecting clothing off a rack. Really I think it is even more unique than that. Geneticists tell us that there have never ever been, nor will there ever be any two single living humans on this planet who are identical. I think that is also true of trees. Notwithstanding the capabilities of the computers, and we've heard a lot about them here today. I think it is not surprising that we encounter situations where the complexity of the decisions that must be made in, say, the headrig situation, are such that time starts to be a factor. I mean, after all, our computers are just getting to the stage where they are able to design and reproduce Cabbage Patch Dolls so that they are unique. Nonetheless, I think we have seen that in specific applications, certainly in the edgers and the trimmers, we have reached a stage where we can achieve a great deal of success.

I think the one word of caution that has been exercised here today is cost benefit. In other words, make sure you know that what you want. Make sure you know that what you are going to buy will do what you want. Make sure you know that it's going to pay back the money you are going to have to spend. I think these are rather unnecessary words of caution to issue to an audience such as we have here today. I don't think we are in too much danger of a "Me-Too" syndrome, given the cost of some of this equipment. We have been concerned of course, about production and I think we tend to focus on reacting to the challenges of getting higher efficiency and higher productivity without a real recognition of the advances that are made.

Our last speaker indicated the sort of revolution that is occurring today in our society; the drift away from the strictly manufacturing jobs, the role of the information specialist. I think we must remember the role of the information specialist in the lumber manufacturing industry and the assistance that can be given to the individual mill manager in optimizing his decisions on a day-to-day basis. I think also we have had some indication of the gains that can be made with the not so high technology. Some of the things that are literally sitting on our doorsteps. All we need to do is apply them. We can make rather substantial gains with regard to both of our objectives—higher efficiency and higher productivity.

I think also today, we had a very worthwhile reflection on the human side of the equation and it was very refreshing to hear both our labor and training people virtually give us the same message. We know there are going to be advances in high technology. Please, please recognize that there are going to be rather substantial upheavals, and consider the consternation that you are going to create in the average household when father comes home and he's been laid off; to be replaced by a robot walking around with a face painted on his top side. Nonetheless, I think the acceptance is there and I think certainly we have to consider the human side of the equation. We have to consider that if we are going to do an effective job of training we are going to have to start now. I think it was very refreshing to hear Dr. McCaffrey indicate that we don't need a two year course. We don't need a four year university degree. But we must have training; much of which can be done on the job, related to the job, and the contining involvement and retraining of our personnel into higher skilled positions.

In conclusion, I think we have had a lot of food for thought.

* * *

Question Period

Question

Could you give us some examples of cases where you have provided assistance?

Answer (Bob Inkpen)

Well, we would love to give some case histories but one of the problems we have is that we can't get too specific because of matters of confidentiality. But a couple of firms do come to mind, which illustrate the kind of projects that we like to see. One of them is C&C Wood Products, which is located in Quesnel. They are a firm that remanufactures pine and produce a pine siding, which has found very good markets throughout the States. They are also looking at overseas markets. Two other firms which we have assisted in Prince George are Skant Industries and Woodlands; again, both of these firms are taking a resource which is here, developing it to a more process state, and again finding good markets with firms such as Ikea.

Question

What level of funding can be provided to industry in British Columbia?

Answer (Bob Inkpen)

We basically operate in terms of targets. The British Columbia region in Canada has a certain budgetary target. In terms of a provincial budget, in past years the two departments have spent approximately 75 million dollars per year, and this has been in all areas from various kinds of manufacturing through our native program and ship building and so on.

We have no specific target as to what funds we will spend in forestry. We are a reactive department, we expect that if people have projects they approach us. If they are projects which are of significant benefit to the country, then we will be happy to provide funding. So how much we spend in forestry in any one year will of course depend on how much activity we are receive in the forestry sector.

We do have some minimums as to funding but no set maximum. Our regional director in Vancouver has authority for grants and contributions up to $250,000. Anything more than this has to go to Ottawa. We are not worried about high amounts, if the project makes sense.

Question

Are those projections valid that you have made on what it was feasible to improve your lumber recovery by? I am curious to know how theoretical that number is or how achievable you think that it can be.

Answer (Al Sadler)

In all fairness, I think it is an achievable and fairly conservative number and we derived that by sampling at the various workstations. This is still allowing a fairly high fall down.

Question

If the fibre optics you put in work the way you expect them to, would you put them on the bottom side as well?

Answer (Ernie Buchacher)

I think generally the thinking is sort of "Let's start with what we have". We have full facilities built into those systems that we can clearly monitor and we can put the test unit on to check the operator decisions. It is set up so that we can spray, mark boards and check the optimizer performance. How much further we go will be dependent on what the incremental pick-up is of what we have now.

Question

Do you still have a trimmer operator?

Answer (Ernie Buchacher)

There will be one man at the board feeder at the head of the trimmer. He's there to hit the kill button. I'm not sure what the final thinking is but one discussion at the time of purchase was that we were not going to attempt to have the operator override the optimizer decisions on the basis that you get out of sequence and start slashing good wood. If he sees defects that the scanner hasn't picked up it is going to result in undertrim and not overtrim. But we still have one operator at the head of the trimmer.

Question

How much undertrim do you expect to develop?

Answer (Ernie Buchacher)

I think the target was four per cent, but that's something you have to play with. You have to be very careful when you cut your undertrimming down too much and any defects that develop through drying or before you get to the planer, you are going to end up with a net loss. So again that is something that has to be monitored.

Question

If you pass too many of those decisions on to the planer mill, do you run the risk of having mistakes made there?

Answer (Ernie Buchacher)

It is something you can monitor very closely.

Question

In the economic analysis, which includes the price of the additional lumber, subtracted packaging and chips, don't you have to subtract planer and drying?

Answer (Al Sadler)

That was one of the reasons we made the undertrim and overtrim the same so that basically, because of the same volumes they handle, you don't have to worry about the costs of planing.

Question

I was a little confused about the sweep edge when you were giving your discussion saying, "minus one inch, or minus two or three inches". That's the area you're working on, yet you're putting one in that will go back to minus 23 inches. That doesn't make sense.

Answer (Ernie Buchacher)

The point I was trying to make was there doesn't appear to be any significant pick-up with increments less than three inches on trimming so you would still have three inch increments, from three up to 21. The additional feature is the accurate length resolution, if you want to be able to shift that fence of increments right up to the two foot between the saws.

Question

How do the sensing devices actually work for edging?

Answer (Fred Hamlin)

The board is scanned every four inches along the length with Reticon cameras, and stepping motors and mirrors that are on the two-scanner system, one is measuring each half. What it does is takes that rough shape, and it has a table of shapes in the edger and they are value-weighted and it fits shapes into that until it comes out with the best value shape. A little while ago the price of 2x12 went sky high and we found out we had too much 2x12 that we couldn't sell. It worked well for a while, but pretty soon we flooded the market.

You can throw your chip prices in and that becomes a factor. If you have specialty items, you can weight specific sizes for them and it will do precisely what you tell it.

Yesterday morning I was working with the mill foreman and the quality people trying to get re-established what a recovered piece of lumber is in terms of a Number 2. Even after 2-1/2 years, we have to keep going back and reminding them. I was down at the reman station and this character was fairly new on the job and was pulling Number 2 lumber back to the edger. That sort of stuff would kill you in a hurry.

It's an education process and your trimmer sawer has to understand what recoverable lumber is. It will make a difference for you. Like I said, all that eight per cent recovery increase wasn't ours, but we like to think at least half of it was and we inspired a major part of it.

* * *

Forintek Canada Corp.

Canada's National Wood Products Research Institute

Established in 1979 as a private, non-profit corporation, Forintek is funded from contract research work, industry support, and government grants and contributions. The staff of 200 is about equally divided between its Western Laboratory in Vancouver and its Eastern Laboratory in Ottawa. The corporate office is located at Vancouver, at the Western Laboratory.

A key element in the operation of Forintek is industry involvement in its research programs. This is accomplished through Research Program Committees and a Board of Directors which consist largely of senior representatives from industry, as well as representatives from federal and provincial governments. It is through these forums that a means is established for industry to have strong input into Forintek's operation, program planning and assessment.

By responding to industry's research needs directly, Forintek plays a vital role in solving technical problems and helping the Canadian wood products industry maintain its competitive position in world markets.

"Productivity improvement" is a common objective for industry and government alike. Accordingly, the federal Department of Industry, Trade and Commerce and Regional Economic Expansion is financing a series of seminars addressing productivity improvement through electronic-based technology. Forintek Canada Corp. will be presenting these seminars on behalf of the federal government during 1983 and 1984.

Enquiries relating to Forintek's services and seminars may be directed to:

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